Exhibit 3

Overview of Kansas Water Resource Laws

Joint Committee on Energy and Environmental Policy

September [illegible], 2009

David W. Barfield, P.E.
Chief Engineer

KANSAS DEPARTMENT OF AGRICULTURE
Division of Water Resources

Outline

- Overview of the state's water resources
- Kansas Water Appropriation Act
- Amendments to the Water Appropriation Act and new laws
- Looking to the future

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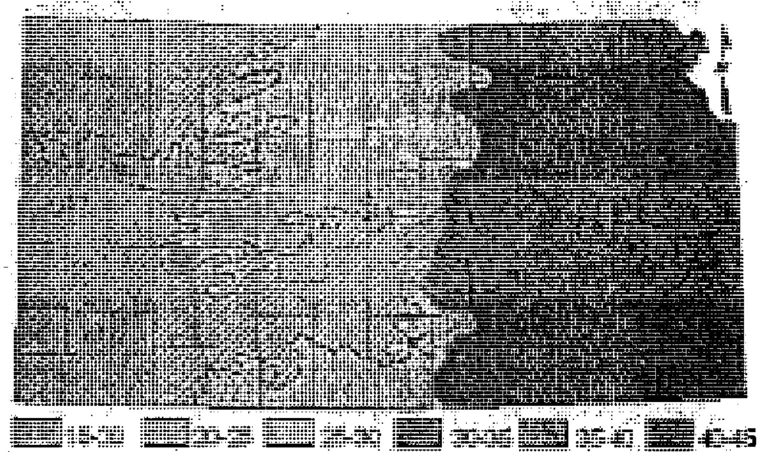
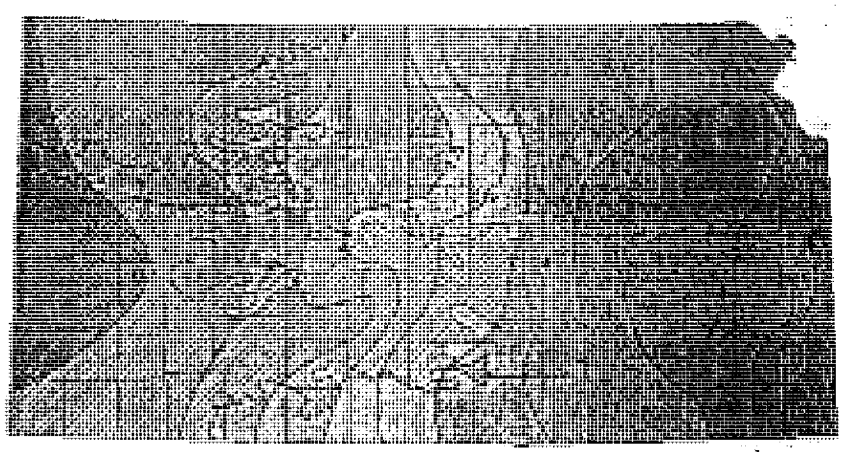
Normal Annual Precipitation



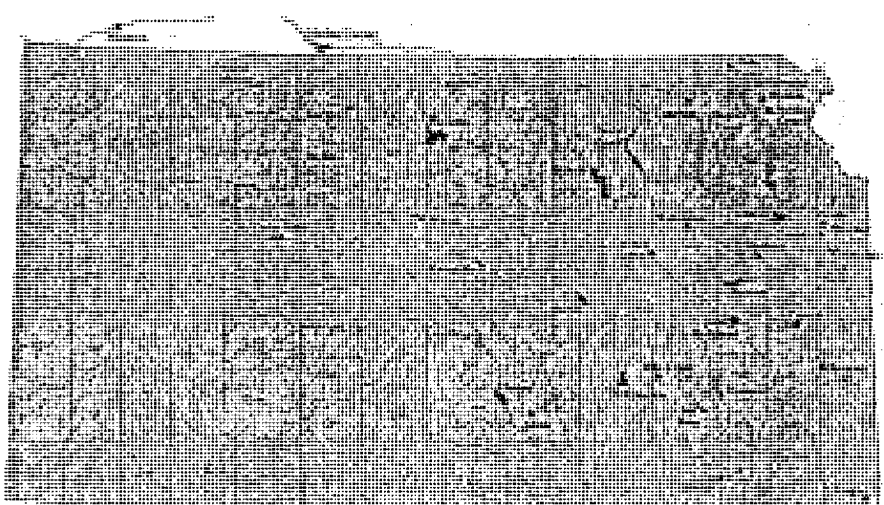
The area west of the dashed line shows the extent of the High Plains aquifer in Kansas (from Goodin et al., 1995)

Average Annual Runoff (Inches)



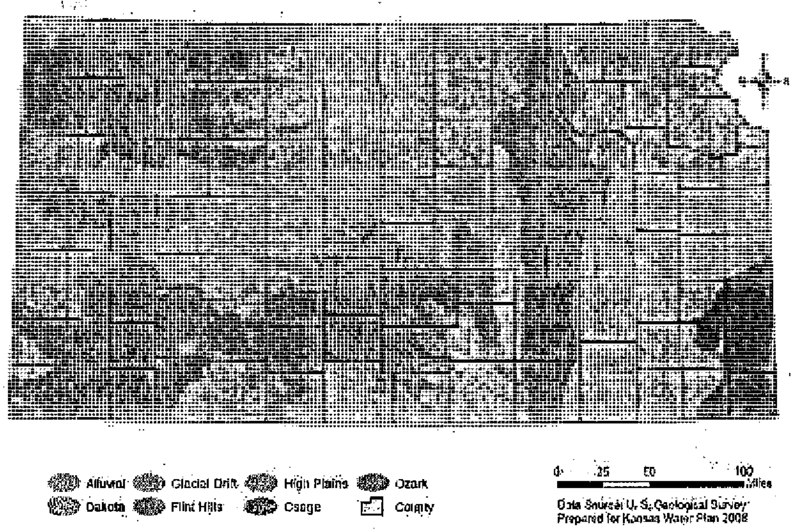
The areas west of the dashed line shows the extent of the High Plains aquifer in Kansas (adapted from Wetter, 1987).

Reservoirs in Kansas



Groundwater Supplies

Major Kansas Aquifers



Kansas Water Appropriation Act (1945)

- All water dedicated to use by Kansans
- Right to use water is based on Prior Appropriation or "First in time, First in Right"
- Limits rights to reasonable needs
- Allocated for beneficial use and to protect minimum desirable streamflows
- Protects investments, property rights and the resource

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Water Appropriation Act

- Single priority system for groundwater and surface water
- A "water right" is not to the ownership of water, but it is a real property right to divert and use water for beneficial purposes with certain limitations
- Domestic use allowed without a permit

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Water Administration

- Chief Engineer is charged with administering the act
  - K.S.A. 82a-706: The Chief Engineer shall enforce and administer the laws of this state pertaining to the beneficial use of water and shall control, conserve, regulate, allot and aid in the distribution of the water resources of the state for the benefits and beneficial uses of all its inhabitants in accordance with the rights of priority of appropriation.

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Water Administration

- During periods of shortage, junior water rights may be curtailed to satisfy senior rights and minimum desirable streamflow
- Releases from storage protected

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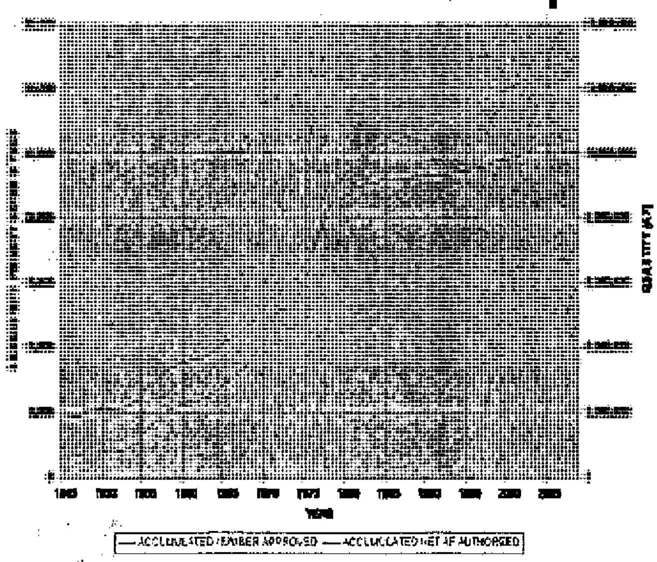
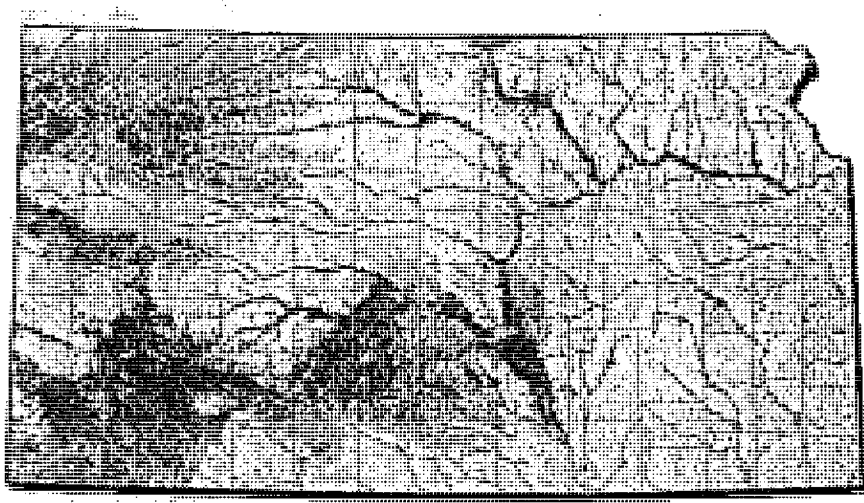
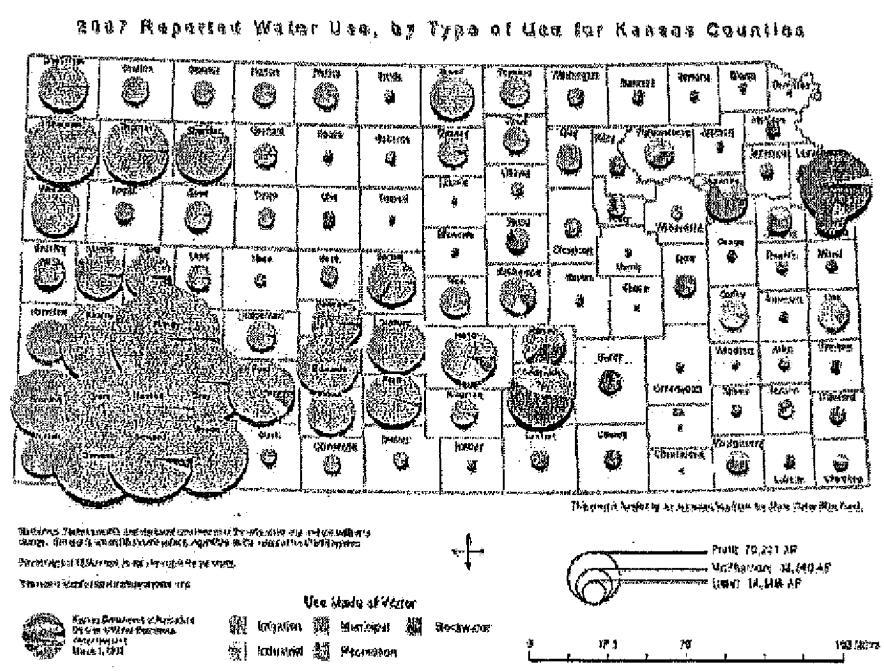
Water Resource Development

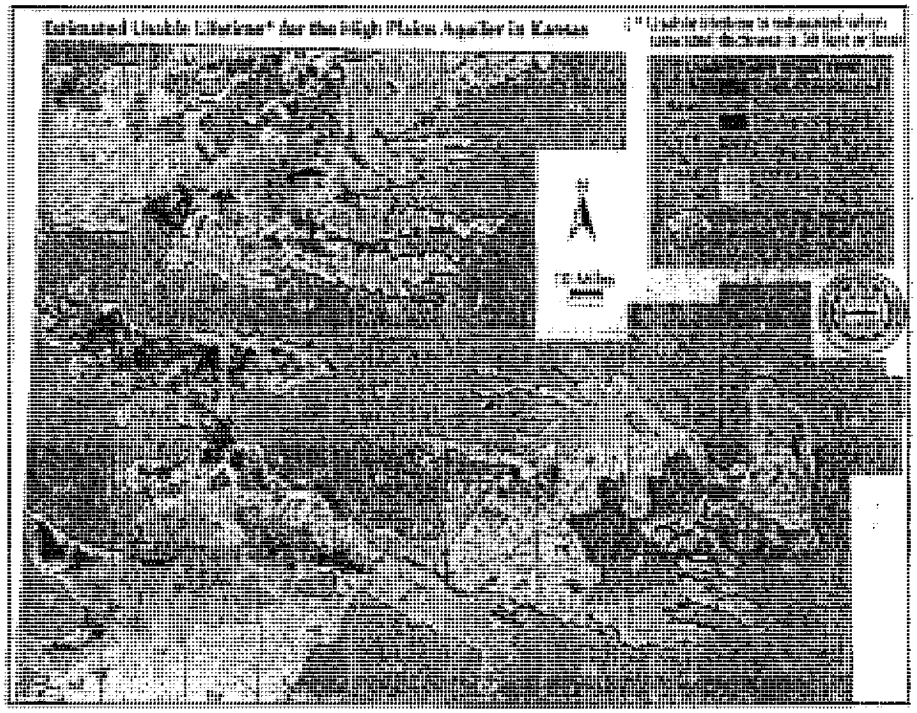


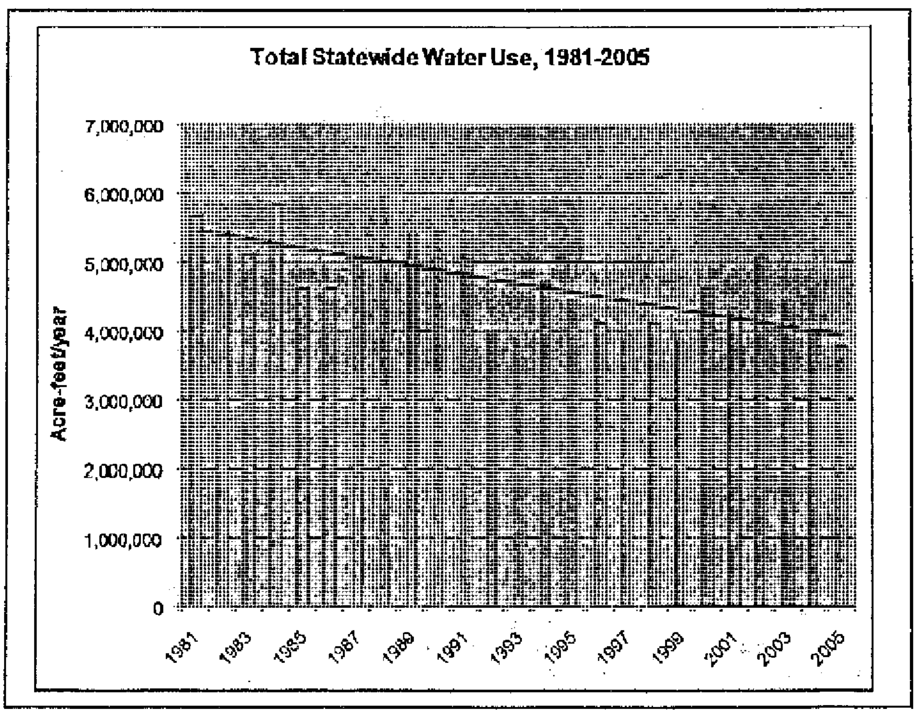
Accumulated number of water rights and authorized quantities.

Diversion Points








Total Statewide Water Use, 1981-2005
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Acre-feet/year
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

Water Availability

- In areas closed to new water rights, additional water use for population growth or new industry can only be accommodated through purchase and conversion of existing water rights
- Changes must pertain to the same local source of supply
- Changes from irrigation to another use such as municipal must not increase consumptive use

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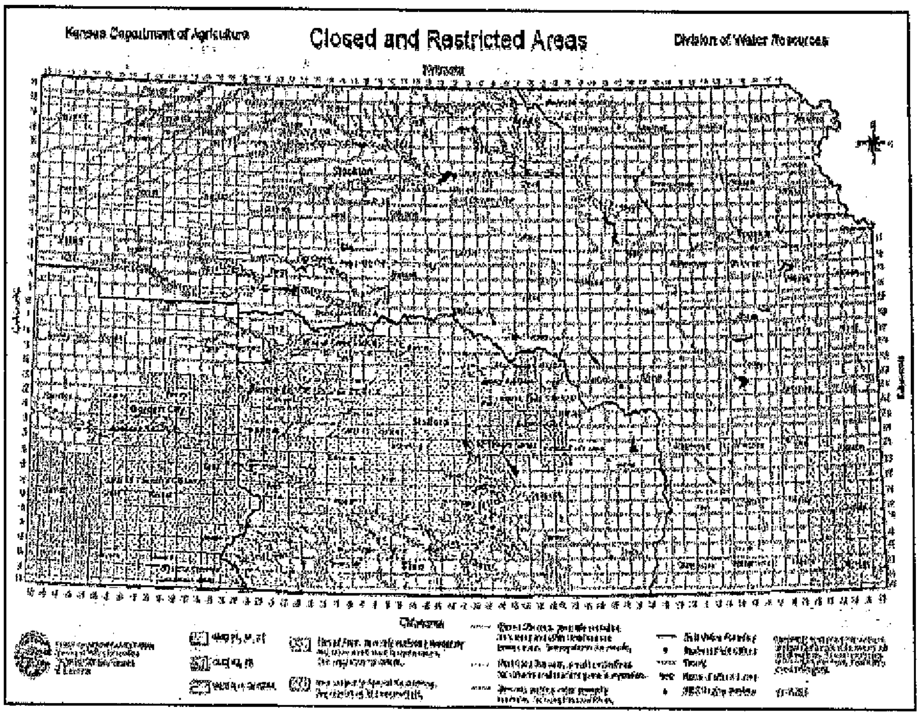

Water Law Changes

Year	Updates to Water Laws
1973	Groundwater Management District Act
1978	KWAA amended to require water rights for all non-domestic uses
1978	GMD Act amended, IGUCA provision added
Early 1980s	Significant new restrictions for new water rights (e.g., safe yield)
1984	Minimum desirable streamflows established
1989	Water use reporting improved via penalties for failure to report
2000	Significant new KWAA regulations

2009 - IGUCA Process
Pawnee R. Basin

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2009/10
x Closed GMD #1
x meters

Groundwater Management District Act

- Allows local control of groundwater policy within the bounds of state law
- Water users and landowners vote; Board elected and local funding
- Must adopt management program
- May recommend rules and regs, as well as IGUCAs
- The Chief Engineer must approve management plan and ensure policies do not conflict with the basic laws of the state

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Water-Level Changes in the High Plains Aquifer, Predevelopment to 2009, 2007–08, and 2008–09, and Change in Water in Storage, Predevelopment to 2009

By V. L. McGuire

Groundwater Resources Program

Scientific Investigations Report 2011–5089

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2011
Revised December 2011

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Acknowledgments

The water-level data used in this report were provided by the following entities through data files or downloads from web sites and loaded into the U.S. Geological Survey National Water Information System:

- Colorado: Division of Water Resources (also known as the Office of the State Engineer);
- Kansas: Department of Agriculture—Division of Water Resources and Kansas Geological Survey;
- Nebraska: Central Nebraska Public Power and Irrigation District, Natural Resources Districts, and University of Nebraska—Lincoln, Conservation and Survey Division;
- New Mexico: Office of the State Engineer;
- Oklahoma: Water Resources Board;
- South Dakota: Department of Environment and Natural Resources;
- Texas: Groundwater Conservation Districts and the Water Development Board;
- Wyoming: State Engineer's Office;
- Bureau of Reclamation, U.S. Fish and Wildlife Service; and
- U.S. Geological Survey offices in Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming.

The author thanks the above entities for providing the water-level data and for their responsiveness regarding questions about the data.

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
square foot (ft^2)	.09290	square meter (m^2)
square mile (mi^2)*	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	.003785	cubic meter (m^3)
cubic foot (ft^3)	.02832	cubic meter (m^3)
acre-foot (acre-ft)**	1,233	cubic meter (m^3)

*There are 640 acres in a square mile (mi^2).

**One acre-foot of water is equivalent to the volume of water that would cover one acre (43,560 ft^2) to a depth of 1 foot (325,851 gallons or 43,560 ft^3).

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Water-Level Changes in the High Plains Aquifer, Predevelopment to 2009, 2007–08, and 2008–09, and Change in Water in Storage, Predevelopment to 2009

By V.L. McGuire

Abstract

The High Plains aquifer underlies 111.8 million acres (175,000 square miles) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Water-level declines began in parts of the High Plains aquifer soon after the beginning of substantial irrigation with groundwater in the aquifer area. This report presents water-level changes in the High Plains aquifer from the time before substantial groundwater irrigation development had occurred (about 1950 and termed "predevelopment" in this report) to 2009, from 2007–08, and from 2008–09. The report also presents change in water in storage in the aquifer, from predevelopment to 2009.

Ninety-nine percent of the water-level changes from predevelopment to 2009 ranged from a rise of 41 feet to a decline of 178 feet. The area-weighted, average water-level changes in the aquifer were a decline of 14.0 feet from predevelopment to 2009, a decline of 0.1 foot from 2007–08, and a decline of 0.3 foot from 2008–09. Total water in storage in the aquifer in 2009 was about 2.9 billion acre-feet, which was a decline of about 273 million acre-feet since predevelopment.

Introduction

The High Plains aquifer underlies 111.8 million acres (175,000 square miles (mi^2)) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming (fig. 1; Qi, 2010). The water generally occurs under unconfined conditions in the aquifer and the water body, from a regional perspective, has a water table at which the water pressure is atmospheric (Weeks and Gutentag, 1981). The saturated thickness of the aquifer, which is the distance from the water table to the base of the aquifer, ranges from less than 50 feet (ft) to about 1,200 ft (McGuire and others, 2003). Gutentag and others (1984) reported that, in a few parts of the aquifer area, the water table is discontinuous; these areas are labeled as "areas of little or no saturated thickness" in figure 1. Wells drilled in areas of little or no saturated thickness (see fig. 8 in Gutentag and others, 1984) likely will not yield water unless the well penetrated saturated sediment in either buried channels or depressions in the bedrock. The aquifer is classified into three regional subdivisions—Northern, Central, and Southern High Plains; there is little groundwater flow in the aquifer between the regional subdivisions (fig. 1; Weeks and others, 1988).

The area overlying the High Plains aquifer is one of the primary agricultural regions in the Nation; in parts of the area, farmers and ranchers began extensive use of groundwater for irrigation in the 1930s and 1940s. Estimated irrigated acreage in the area overlying the High Plains aquifer, which increased from 1940 to 1980, did not change greatly from 1980 to 2005: 1949—2.1 million acres, 1980—13.7 million acres, 1997—13.9 million acres, 2002—12.7 million acres, 2005—15.5 million acres (Heimes and Luckey, 1982; Thelin and Heimes, 1987; U.S. Department of Agriculture, 1999 and 2004; Kenny and others, 2009). In 2005, irrigated acres overlaid 14 percent of the aquifer area, not including the areas with little or no saturated thickness (Kenny and others, 2009).

About every 5 years, groundwater withdrawals for irrigation and other uses are compiled from water-use data and reported by the U.S. Geological Survey (USGS) and State agencies. Groundwater withdrawals from the High Plains aquifer for irrigation increased from 4 to 19 million acre-feet (acre-ft) from 1949 to 1974; groundwater withdrawals for irrigation in 1980, 1985, 1990, and 1995 were 4 to 18 percent less than withdrawals for irrigation in 1974 (Heimes and Luckey, 1982; U.S. Geological Survey, 2008). Groundwater withdrawals from the aquifer for irrigation were 21 million acre-ft in 2000 and 19 million acre-ft in 2005 (Maupin and Barber, 2005; U.S. Geological Survey, 2008; Kenny and others, 2009).

Water-level declines began in parts of the High Plains aquifer soon after the onset of substantial irrigation using groundwater—about 1950 (Gutentag and others, 1984). By 1980, water levels in the High Plains aquifer in parts of Texas, Oklahoma, and southwestern Kansas had declined more than 100 ft (Luckey and others, 1981).

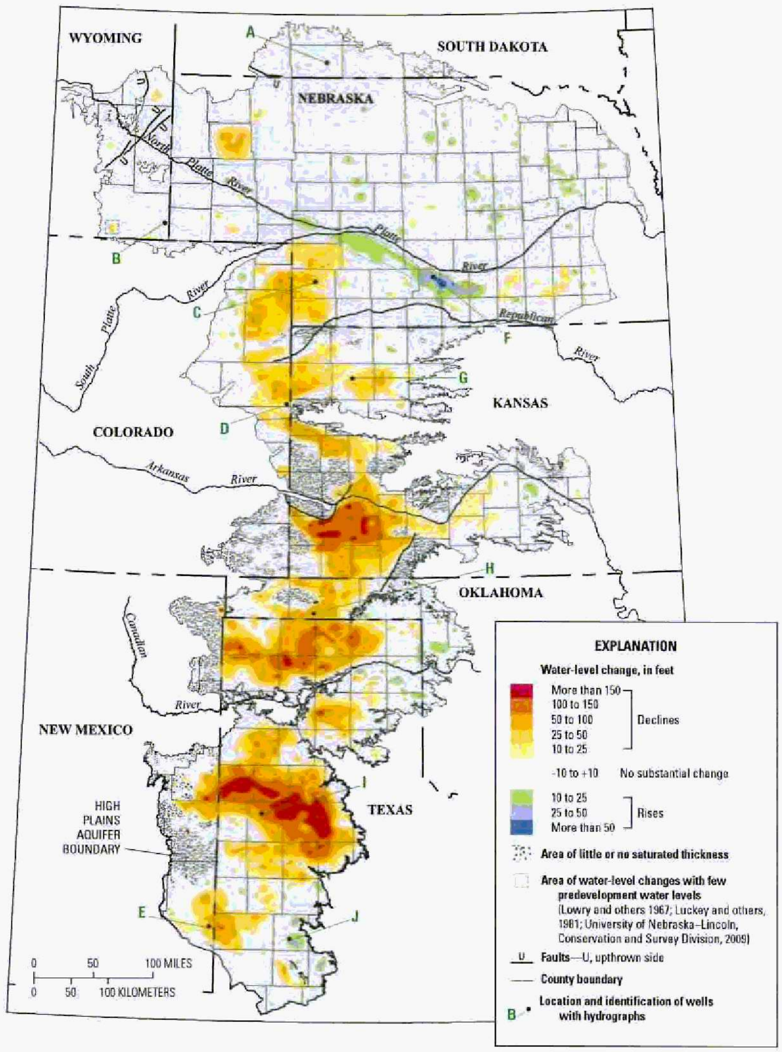
Long-term water-level changes in the aquifer result from an imbalance between discharge and recharge. Discharge from the High Plains aquifer primarily consists of groundwater

Exhibit 4

USGS
science for a changing world

Groundwater Resources Program

Water-Level Changes in the High Plains Aquifer, Predevelopment to 2009, 2007–08, and 2008–09, and Change in Water in Storage, Predevelopment to 2009



Scientific Investigations Report 2011–5089

U.S. Department of the Interior
U.S. Geological Survey

Intensive Groundwater Use Control Areas (IGUCA)

- Water management tool that works in conjunction with the Kansas Water Appropriation Act
- Provides alternatives to strict administration of water rights by priority
- Allows for flexible solutions
- Chief engineer can amend an IGUCA in the public interest

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Intensive Groundwater Use Control Areas (IGUCA)

- Eight IGUCA's are located in the state
- Formal public hearings are held
- KDA recently developed a regulation that provides for an independent hearing officer to decide initiation of an IGUCA
- If an IGUCA is designated, corrective control provisions are implemented through an order

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Intensive Groundwater Use Control Areas (IGUCA)

- Advisory committees/task forces have been established to make recommendations
- KDA also developed a new regulation to require formal reviews of IGUCAs to determine whether they should be continued

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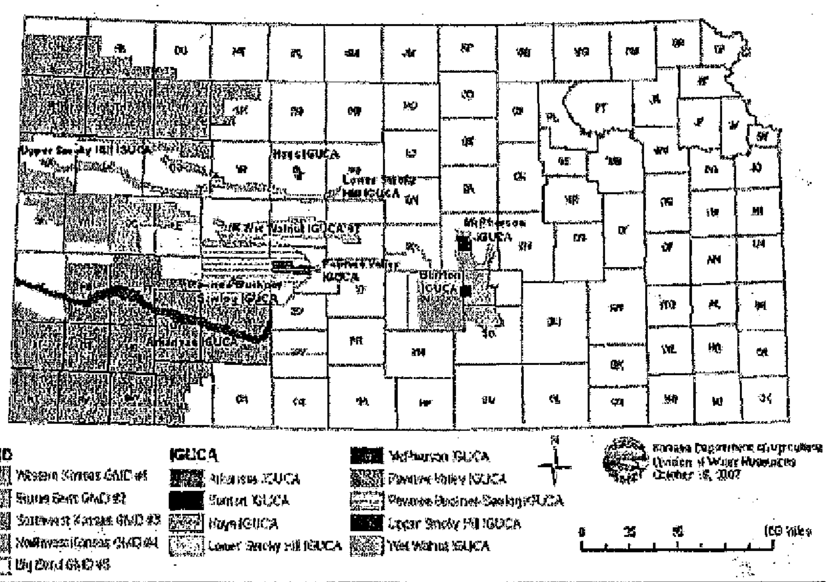
Intensive Groundwater Use Control Areas in Kansas



State Water Plan Storage Act

- Authorizes state-controlled storage in federal reservoirs
- Yield based on 2 percent chance of drought
- Considers existing and future needs of applicants
- Releases made pursuant to contracts
- Releases protected from use by other users

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Water Assurance Program Act

- Based on 1985 agreement with the Corps of Engineers
  - Requires state to protect water quality releases
- Allowed state to acquire additional storage at original cost
- Operate reservoirs as a system to meet downstream needs
- Limited to municipal and industrial water rights

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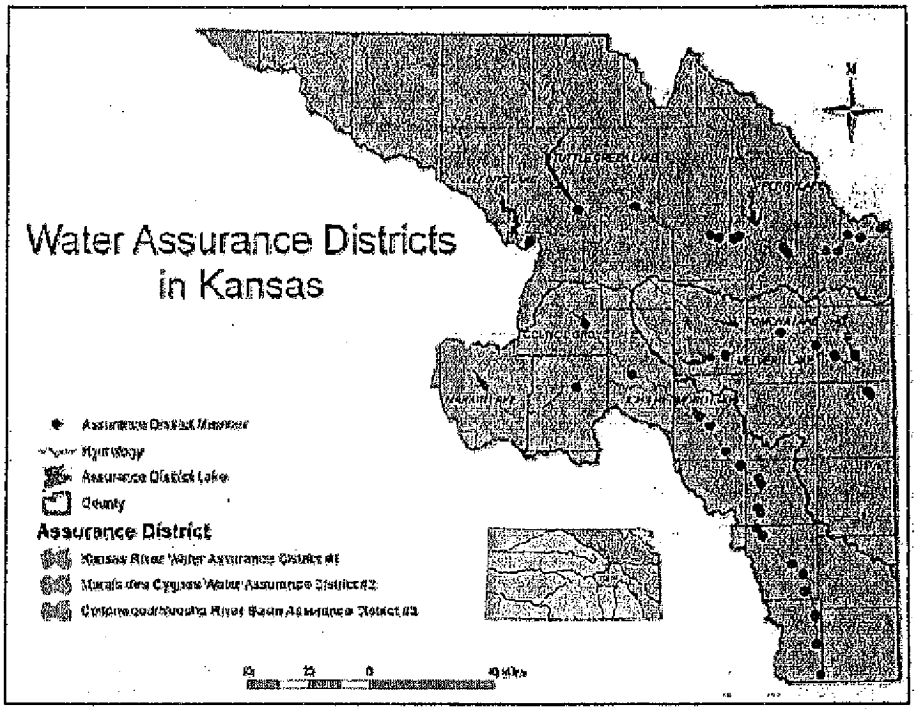

Water Transfer Act

- Requires a hearing for any proposal to divert and transport 2,000 acre-feet of water or more per year for beneficial use at a location greater than 35 miles from the source
- Does not include a release of water from a reservoir to the water's natural watercourse for use within the natural watercourse or watershed, made under the authority of the state water plan

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Water Transfer Act

- Presiding officer conducts a hearing and renders an initial order approving or denying an application for water transfer
- The review of the hearing officer's order is made by a panel consisting of the Chief Engineer, the Director of the KWO and the Secretary of KDHE or Director of the Division of Environment, which shall constitute the final order

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Current Management

- All areas now closed or subject to "safe yield", comparing the source of supply vs. existing water rights
- Changes to water rights cannot increase consumptive use or impair other water rights
- Improved compliance and enforcement, water use reporting

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Looking to the Future

- The state has a good set of laws to regulate water development and use, but challenges remain.
  - Non-sustainable development in western Kansas resulting in declining baseflow to streams, inflows to reservoirs; increased impairment complaints; uncertainty on future supplies
  - More firm supplies to meet future needs
  - Reservoir sediment reducing yields

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Looking to the Future

- Kansas required to meet interstate compact commitments in addition to in-state needs
  - Using state-of-the-art computer modeling to evaluate supplies and management
  - Coordination and policy development through Kansas Water Authority and water plan processes, interaction with GMDs and other districts and stakeholders
  - Local input important, state control necessary

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Looking to the Future

- Agencies charged to administer water laws need adequate resources and support
  - Division of Water Resources has experienced a 20 percent State General Fund budget reduction in fiscal years 2009 and 2010, which is resulting in a 20 percent staff reduction
  - Modest fee increases to sustain current services requested in 2009 were not passed

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Topics for the Presentation in Afternoon

- Water use for energy production
- Water resources near Wolf Creek
- Wolf Creek water rights and assurance district contracts
- Options for securing additional water
- Kansas Water Office will discuss regional supplies

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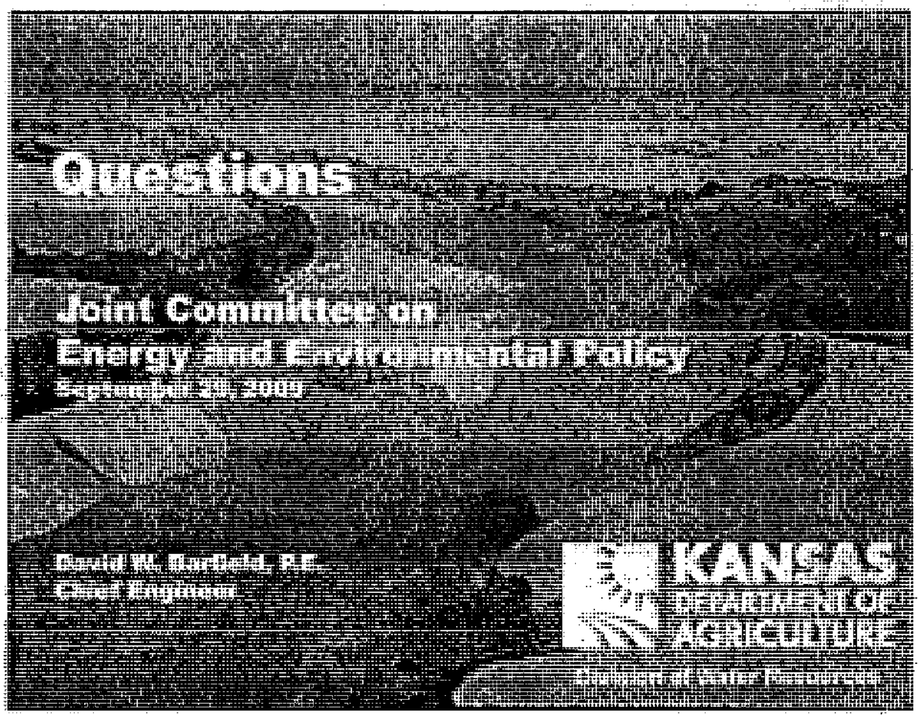
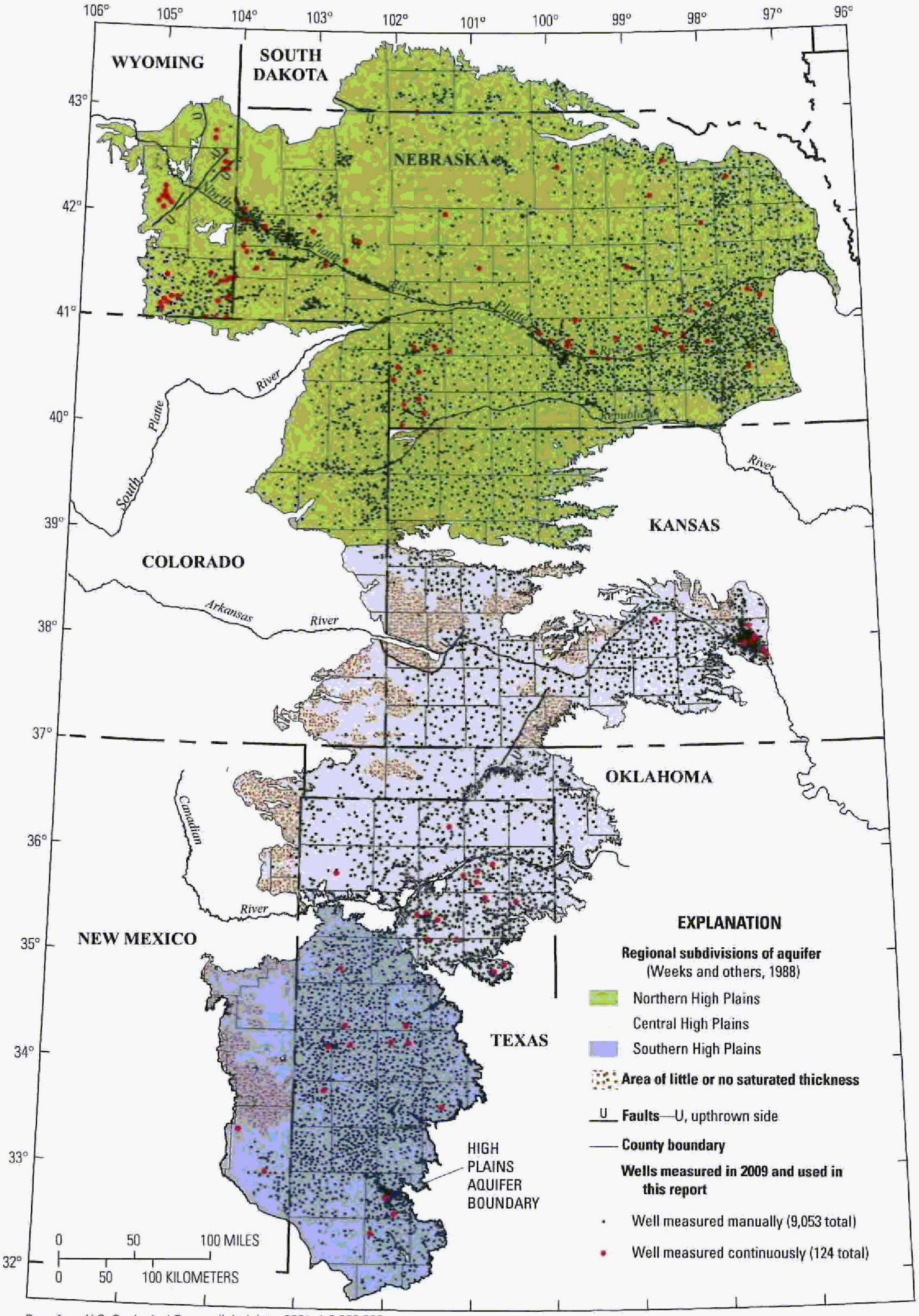

Questions
Joint Committee on
Energy and Environmental Policy
KANSAS
DEPARTMENT OF
AGRICULTURE



Base from U.S. Geological Survey digital data, 2001, 1:2,000,000
Albers Equal-Area projection
Standard parallels 29° 30' and 45° 30', central meridan -101°

Figure 1. Regional subdivisions of the High Plains aquifer and location of wells measured in 2009 and used in this report.

withdrawals for irrigation, but also includes groundwater withdrawals for public supply and other uses, evapotranspiration where the water table is near land surface, and seepage to streams, springs, and other surface-water bodies where the water table intersects the land surface (Maupin and Barber, 2005). Recharge to the aquifer primarily is from precipitation, but other sources of recharge include seepage from streams, canals, and reservoirs, and irrigation return flows (Luckey and Becker, 1999). Water-level declines may result in increased costs for groundwater withdrawals because of increased pumping lift and decreased well yields (Taylor and Alley, 2001). Water-level declines also can affect groundwater availability, surface-water flow, and near-stream (riparian) habitat areas (Alley and others, 1999).

In response to water-level declines, Congress directed the USGS to monitor water levels in the aquifer; in 1987, the USGS, in collaboration with numerous Federal, State, and local water-resources entities (see "Acknowledgments" section), began monitoring water levels in more than 7,000 wells. Water levels for 2007 were based on measurements from 9,297 wells, water levels for 2008 were based on measurements from 9,416 wells, and water levels for 2009 were based on measurements from 9,177 wells (table 1; fig. 1; Kansas Geological Survey, 2010; Texas Water Development Board, 2010; U.S. Geological Survey, 2011).

This report presents water-level changes in the High Plains aquifer from the time before substantial development of groundwater for irrigation to 2009, from 2007–08, and from 2008–09. The time before substantial development of groundwater for irrigation is termed "predevelopment" in this report; predevelopment generally is before about 1950, but, in some areas (for example in the north-central part of the Texas Panhandle), predevelopment is the late 1990s and in other areas (for example in north-central Nebraska), substantial development of groundwater for irrigation has not occurred to date (2011). Water levels used in this report generally were measured in winter or early spring, when irrigation wells typically were not pumping and water levels generally had recovered from pumping during the previous irrigation season. This report also describes the amount of drainable water in storage in the High Plains aquifer in 2009 and the change in the amount of drainable water in storage in the aquifer from predevelopment to 2009. Drainable water in storage is the fraction of water in the aquifer that will drain by gravity and can be withdrawn by wells. The remaining water in the aquifer is held to the aquifer material by capillary forces and generally cannot be withdrawn by wells. Drainable water in storage is termed "water in storage" in this report.

Table 1. Number of wells used in this report for 2007, 2008, and 2009 water levels, and for the water-level comparison periods—predevelopment to 2009, 2007–08, and 2008–09 by State, by regional subdivision of the High Plains aquifer, and in total.

	Number of wells measured			Number of wells used in water-level comparison for indicated period		
	2007	2008	2009	Predevelopment to 2009	2007–08	2008–09
State						
Colorado	496	502	357	263	456	343
Kansas	1,722	1,761	1,746	566	1,386	1,661
Nebraska	3,934	3,929	3,802	1,584	3,829	3,761
New Mexico	105	67	72	116*	37	38
Oklahoma	121	148	135	92	111	131
South Dakota	113	111	106	71	110	104
Texas	2,749	2,839	2,687	726	2,410	2,383
Wyoming	57	59	272	21	55	53
Regional subdivision of the High Plains aquifer (Weeks and others, 1988)						
Northern High Plains	4,933	4,914	4,873	2,096	4,711	4,569
Central High Plains	2,385	2,586	2,475	943	1,937	2,240
Southern High Plains	1,979	1,916	1,829	400	1,746	1,665
High Plains aquifer	9,297	9,416	9,177	3,439	8,394	8,474

*For 99 wells in the predevelopment-to-2009 water-level comparison period, 2005, 2006, 2007, or 2008 water levels were used instead of 2009 water levels because many wells in New Mexico are measured only once every 5 years or because the 2009 water level was not a static water level.

Data and Methods

Water-Level Data

The water level from the wells used in this report generally are measured with an electric or steel tape using methods similar to those described by Stallman (1971). Most of the wells are manually measured 1 to 2 times per year—generally in the winter or early spring and in late fall. Some wells are measured nearly continuously by using instrumentation (data recorders and sensors or floats) installed in the well that records the water level periodically (generally every 15 to 30 minutes) (Cunningham and Schalk, 2011). In 2009, 124 of the 9,177 wells measured and used in this report were measured continuously (fig. 1). The wells are measured by numerous Federal, State, and local water-resources agencies (see "Acknowledgments" section).

Characterizing Water-Level Changes, Predevelopment to 2009

The map of water-level changes from predevelopment to 2009 was developed by first using a geographic information system (GIS) (ESRI® Arc/Info™ version 9.3) to interpolate from point measurements to a grid of water-level changes (using the GIS function, TOPOGRID), and then modeling the TOPOGRID-output grid as a contoured surface using the "contour" GIS command (Environmental Systems Research Institute, 1992 and variously dated). The data inputs to the GIS TOPOGRID function were the water-level-change values from wells measured in both the predevelopment and 2009 periods and the contours of water-level changes, predevelopment to 2007 (McGuire, 2009). The initial water-level-change contours and supplemental water-level-change data from water-level measurement in other wells and from published maps were used to create the final water-level-change contours for the predevelopment to 2009 period. The supplemental water-level-change data were from:

1. Wells measured in the predevelopment period and in at least one of the 2005–08 periods, but not in the 2009 period;
2. Wells measured before June 15, 1978 (but not during or before the predevelopment period for the area), and in the 2009 period;
3. Wells measured in 1980 and 2009 and contours from published maps of water-level changes, predevelopment to 1980 (Luckey and others, 1981); and
4. For parts of the aquifer in Nebraska and Wyoming with few predevelopment water levels, contours from published maps of water-level changes since predevelopment (Lowry and others, 1967; Luckey and others, 1981; University of Nebraska–Lincoln, Conservation and Survey Division, 2009).

Characterizing Water-Level Changes, 2007–08 and 2008–09

Since 1988, annual area-weighted, average water-level changes had been calculated using Thiessen polygons (Thiessen, 1911) because a larger number of wells were available with water levels measured in both adjacent reporting years (1988–2009) and, therefore, the Thiessen polygon method produced a reasonable value for annual area-weighted, average water-level changes (Kastner and others, 1989; Dugan and others, 1990 and 1994; Dugan and Schild, 1992; McGrath and Dugan, 1993; Dugan and Cox, 1994; Dugan and Sharpe, 1996; McGuire and Sharpe, 1997; McGuire and Fischer, 1999; McGuire, 2001, 2003, 2004a, 2004b, 2007, and 2009). For this report, maps of generalized annual water-level changes, 2007–08 and 2008–09, were constructed using Thiessen polygons (ESRI® Arc/Info™ version 9.3) to maintain consistency with previous reports. Thiessen polygons apportion the water-level change in each well to an area around the well; the size and shape of each polygon depends on the well's proximity to neighboring wells. The area-weighted, average water-level change values for 2007–08 and 2008–09 were computed by summing the quantities equal to the area in acres of each Thiessen polygon multiplied by the actual water-level change value for each corresponding well, and then dividing the sum by the aquifer area, excluding areas with little or no saturated thickness. The maps of generalized annual water-level change for 2007–08 and 2008–09 are not included in this report because this report emphasizes long-term water-level changes; however, the associated area-weighted, average values of water-level change and change in water in storage are presented.

Calculation of Area-Weighted Average Water-Level Changes, Predevelopment to 2009

Starting in 2000, area-weighted, average water-level changes since predevelopment have been calculated using a gridded version of the map of water-level changes from predevelopment to the reporting year (2000, 2001, 2002, 2003, 2005, 2007, and 2009). The Thiessen polygon method was not used to calculate area-weighted, average water-level changes from predevelopment to the reporting year because there are a smaller number of wells available with water levels measured in both the predevelopment and the applicable report year periods, which could cause the Thiessen polygon-based method to produce unrealistic estimates in the areas where such wells were sparse (McGuire, 2001, 2003, 2004a, 2004b, 2007, and 2009; McGuire and others, 2003).

Using the grid-based method, area-weighted, average water-level changes from predevelopment to the reporting year was calculated by multiplying the cell area (61.8 acres) by the specified value for the associated polygon; summing the result; and then dividing the sum by the aquifer area, excluding the areas with little or no saturated thickness. Each polygon in the contour map of water-level changes represents a range in water-level changes, The specified value for the associated polygon typically was set to the mid-range value of the water-level-change range associated with the polygon. Alternatively, the specified value was set to 50 ft for areas of water-level rises greater than 50 ft, -150 ft for areas of water-level declines greater than 150 ft, and 0 ft for areas of little or no saturated thickness.

Calculation of Change in Water in Storage and Total Water in Storage

Change in drainable water in storage in the High Plains aquifer for each period was calculated using the area-weighted, average specific yield of 0.15 for the High Plains aquifer (Gutentag and others, 1984) and change in the saturated volume of the High Plains aquifer for the period from the corresponding water-level-change map. Specific yield of a rock or soil, with respect to water, is the ratio of (1) the volume of water, which the saturated rock or soil will yield by gravity, to (2) the rock or soil volume (Meinzer, 1923). The specific yield of the High Plains aquifer ranges from near 0 to 0.30 (Gutentag and others, 1984). In this report and to be consistent with previous reports (Kastner and others, 1989; McGuire, 2009), the change in saturated aquifer volume, predevelopment to 2009, was calculated as the sum of the changes in saturated volume for the predevelopment to 2000 period (McGuire and others, 2003), 2000 to 2007 period (McGuire, 2003, 2004a, 2004b, 2007, and 2009), 2007–08 period, and 2008–09 period.

Total water in storage in the High Plains aquifer in 2009 was calculated by summing the volume of water in storage in 2000 and the annual changes in water in storage, 2000 to 2009 (McGuire, 2003, 2004a, 2004b, 2007, and 2009). Water in storage in 2000 was derived by multiplying the saturated aquifer volume in 2000 by the area-weighted, average specific yield of the aquifer (0.15). The saturated aquifer volume in 2000 was calculated using a gridded version (61.8-acre cells) of the map of saturated thickness in 2000 (McGuire and others, 2003), multiplying the area of each cell times the midrange value of the associated saturated-thickness contour interval; and summing the results. Saturated thickness in 2000 was mapped as the difference between superimposed contours of the altitude of the water table in 2000 and contours of the altitude of the base of the aquifer (Weeks and Gutentag, 1981; Borman and Meredith, 1983; Borman and others, 1984; Hart and McAda, 1985; Juracek and Hansen, 1995; Luckey and Becker, 1999; Houston and others, 2003). Annual changes in water in storage for 2000–01, 2001–02, 2002–03, 2003–04, 2004–05, 2005–06, 2006–07, 2007–08, and 2008-09 were computed for each time period by multiplying the associated annual area-weighted, average water-level change by the aquifer area and the area-weighted, average specific yield of the aquifer (0.15).

Characterizing Change in Saturated Thickness, Predevelopment to 2009

Change in saturated thickness, predevelopment to 2009, was mapped by contouring the ratio of water-level change to predevelopment saturated thickness using predevelopment and 2009 water-level data and altitude data for the base of the aquifer. The contours were constructed initially by using TOPOGRID, a GIS function, and then modeling the output grid as a contoured surface using the "contour" GIS command (Environmental Systems Research Institute, 1992 and variously dated). The data inputs to TOPOGRID were the change in saturated thickness from wells measured in both predevelopment and 2009, as a percent. The initial changes in saturated-thickness contours were used with supplemental data to construct the final contours. The supplemental data were changes in saturated-thickness data, in percent, from:

1. Wells measured in the predevelopment period and in at least one of the 2005–08 periods, but not in the 2009 period;
2. Wells measured before June 15, 1978 (but not in or before the predevelopment period for the area), and in the 2009 period;
3. Wells measured in 1980 and 2009 and contours from published maps of water-level changes, predevelopment to 1980 (Luckey and others, 1981); and
4. For parts of the aquifer in Nebraska and Wyoming with few predevelopment water levels, contours from published maps of water-level changes since predevelopment (Lowry and others, 1967; Luckey and others, 1981; University of Nebraska–Lincoln, Conservation and Survey Division, 2009).

Water-Level Changes, Predevelopment to 2009

The map of water-level changes in the High Plains aquifer from predevelopment to 2009 (fig. 2) is based on water levels from 3,439 wells (table 1) and on other published data (Lowry and others, 1967; Luckey and others, 1981; University of Nebraska–Lincoln, Conservation and Survey Division, 2009). The other published data were used in areas in Nebraska and Wyoming with few predevelopment water levels (fig. 2). Water-level changes from predevelopment to 2009 ranged from a rise of 84 ft in Nebraska in the Northern High Plains subdivision to a decline of 234 ft in Texas in the Southern High Plains subdivision; 99 percent of the wells had water-level changes from predevelopment to 2009 that ranged from a rise of 41 ft to a decline of 178 ft. The area-weighted, average water-level change from predevelopment to 2009 was a decline of 14.0 ft; the area-weighted, average water-level change from predevelopment to 2009 by State ranged from a decline of 36.7 ft in Texas to no change in South Dakota. Area-weighted, average water-level change from predevelopment to 2009 by regional subdivision of the aquifer ranged from a decline of 34.3 ft in the Southern High Plains subdivision to a decline of 2.9 ft in the Northern High Plains subdivision (table 2). From predevelopment to 2009, water levels declined more than 10 ft in about 26 percent of the aquifer area, more than 25 ft in about 18 percent of the aquifer area, and more than 50 ft in about 11 percent of the aquifer area. In approximately 72 percent of the aquifer area, water-level changes ranged from a 10-ft decline to a 10-ft rise. In approximately 2 percent of the aquifer area, water levels rose more than 10 ft from predevelopment to 2009.

Hydrographs for 10 wells screened in the High Plains aquifer are presented (fig. 3) to illustrate changes in water levels at selected locations (fig. 2). The hydrographs show altitude of land surface, water levels, and the estimated base of the aquifer at each selected location. The hydrographs include water-level records for wells where water levels have declined (figs. 3*B*, 3*C*, 3*D*, 3*E*, 3*G*, 3*H*, and 3*I*), a well where water levels have risen (fig. 3*F*), a well where water levels have not changed substantially (fig. 3*A*), and a well where water levels have risen and declined (fig. 3*J*).

Water-Level Changes, 2007–08

Water levels were measured in 8,394 wells before the irrigation season in both 2007 and 2008 (table 1); the irrigation season generally begins in May, but the actual dates depend on location. Water-level changes in the measured wells ranged from about a 15-ft decline in Kansas in the Central High Plains subdivision to about an 11-ft rise in Texas in the Southern High Plains subdivision; 99 percent of the wells had water-level changes from 2007–08 that ranged from a decline of 8 ft to a rise of 7 ft. Water-level declines of 3 ft or greater occurred in 6 percent of the measured wells. The area-weighted, average water-level change in the High Plains aquifer from 2007–08 by State ranged from a 1.1-ft decline in Colorado to a 0.4-ft rise in Nebraska (table 2); area-weighted, average water-level change in the High Plains aquifer from 2007–08 by the aquifer's regional subdivisions ranged from a decline of 0.6 ft in the Central High Plains subdivision to a rise of 0.2 ft in the Southern High Plains subdivision. Overall, the area-weighted, average water-level change in the High Plains aquifer during 2007–08 was a 0.1-ft decline (table 2).

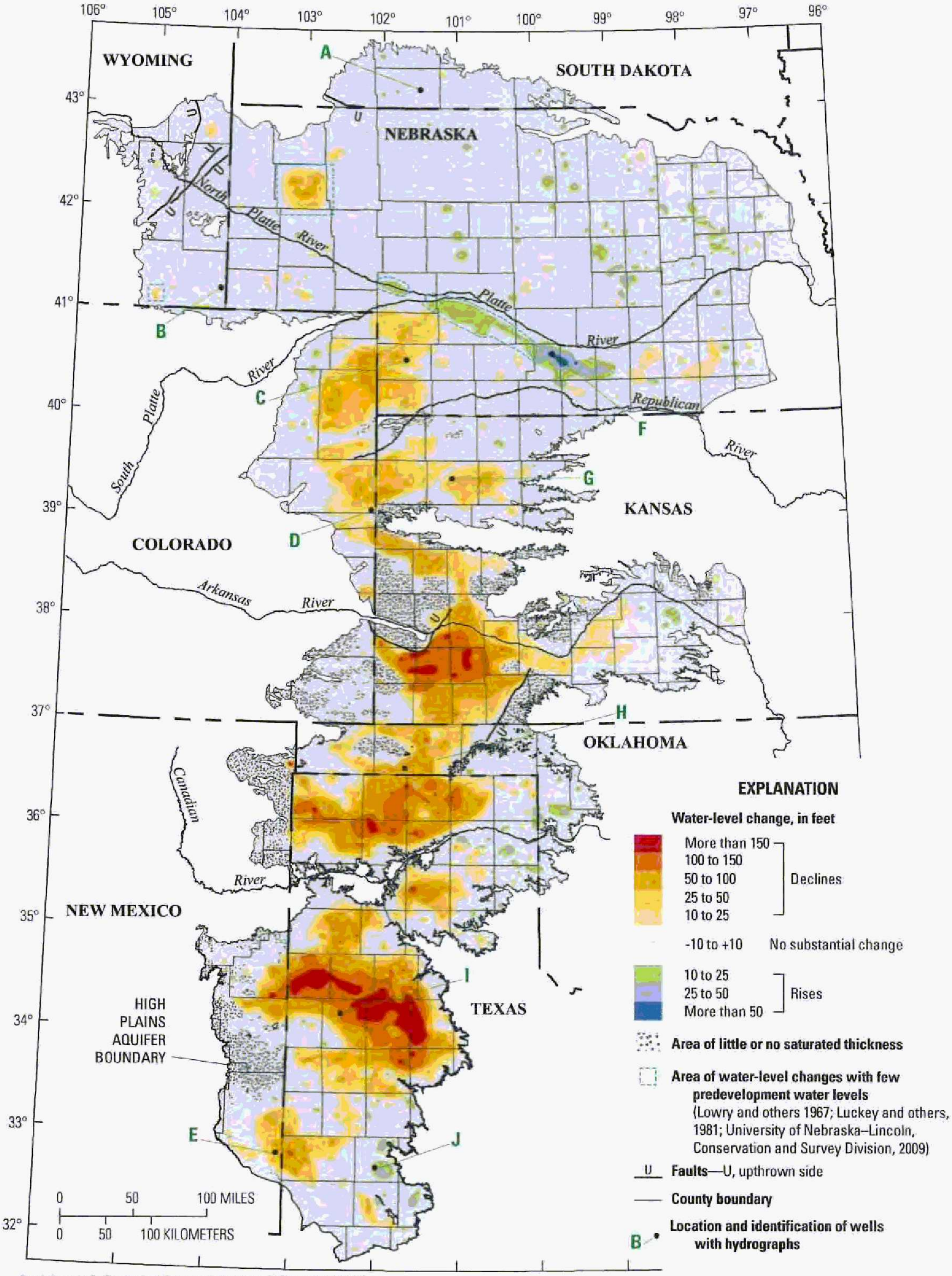
Water-Level Changes, 2008–09

Water levels were measured in 8,474 wells before the irrigation season in both 2008 and 2009 (table 1). Water-level changes in the measured wells ranged from about a 13-ft decline in Texas in the Southern High Plains subdivision to about an 11-ft rise in Nebraska in the Northern High Plains subdivision; 99 percent of the wells had water-level changes from 2008–09 that ranged from a decline of 9 ft to a rise of 7 ft. Water-level declines of 3 ft or greater occurred in 8 percent of the measured wells. The area-weighted, average water-level change from 2008–09 by State ranged from a 1.6-ft decline in New Mexico to a 0.4-ft rise in Nebraska (table 2); area-weighted, average water-level change from 2008–09 by the aquifer's regional subdivisions ranged from a decline of 1.1 ft in the Southern High Plains subdivision to a rise of 0.2 ft in the Northern High Plains subdivision. Overall, the area-weighted, average water-level change in the High Plains aquifer during 2008–09 was a 0.3-ft decline (table 2).

Table 2. Area-weighted, average water-level changes in the High Plains aquifer, not including the areas of little or no saturated thickness—predevelopment to 2009, 2007–08, and 2008–09 by State, by regional subdivision of the aquifer, and in total.

[Positive values for water-level rises; negative values for water-level declines.]

	Area-weighted, average water-level change		
	Predevelopment to 2009 (feet)	**2007–08 (feet)**	**2008–09 (feet)**
	State		
Colorado	-13.2	-1.1	-0.6
Kansas	-22.8	-.2	-.4
Nebraska	-.9	.4	.4
New Mexico	-15.1	-.4	-1.6
Oklahoma	-12.3	-.4	-.7
South Dakota	0	0	.1
Texas	-36.7	-.1	-1.1
Wyoming	-.4	-.5	.1
Regional subdivision of the High Plains aquifer (Weeks and other, 1988)			
Northern High Plains	-2.9	0.1	0.2
Central High Plains	-26.5	-.6	-.9
Southern High Plains	-34.3	.2	-1.1
High Plains aquifer	-14.0	-.1	-.3



Base from U.S. Geological Survey digital data, 2001, 1:2,000,000
Albers Equal-Area projection
Standard parallels 29° 30' and 45° 30', central meridan -101°

Figure 2. Water-level changes in the High Plains aquifer, predevelopment to 2009 (modified from Gutentag and others, 1984).

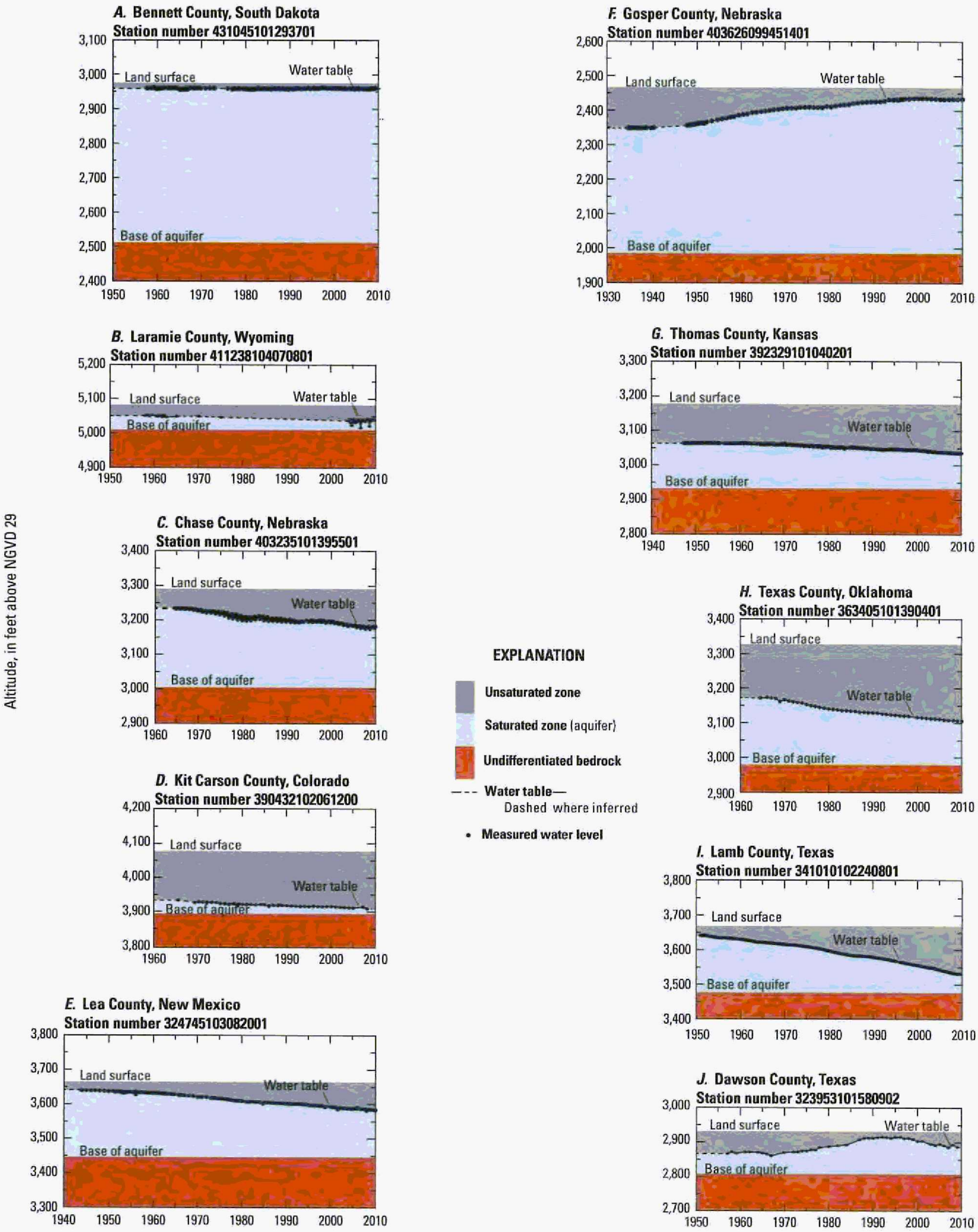


Figure 3. Hydrographs of water levels for selected wells. [See figure 2 for well locations; use station number to query water-level history in U.S. Geological Survey National Water Information System (U.S. Geological Survey, 2011)].

Change in Water in Storage, Predevelopment to 2009

Water in storage in the High Plains aquifer in 2009 was about 2.9 billion acre-ft (fig. 4), which was a decline of about 273 million acre-ft (or about 9 percent) since predevelopment storage (table 3). Changes in storage that may have occurred before the predevelopment period used for this report were not estimated.

The representation of a given change in the volume of water in storage in an area depends partly on the predevelopment saturated thickness of the aquifer. The map of percentage change in saturated thickness (fig. 5) presents predevelopment-to-2009 water-level changes as a percentage of predevelopment saturated thickness. This map (fig. 5) is similar in some areas to the water-level-change map (fig. 2); however, an area of large water-level change would not result in a substantial percentage change if predevelopment saturated thickness was large relative to the water-level change. Conversely, an area with small water-level change may result in a large percentage change in saturated thickness because of small predevelopment saturated thickness. By 2009, 13 percent of the aquifer area had more than a 25-percent decrease in saturated thickness since predevelopment, 5 percent of the aquifer area had more than a 50-percent decrease in saturated thickness, and less than 1 percent of the aquifer area had more than a 10-percent increase in saturated thickness.

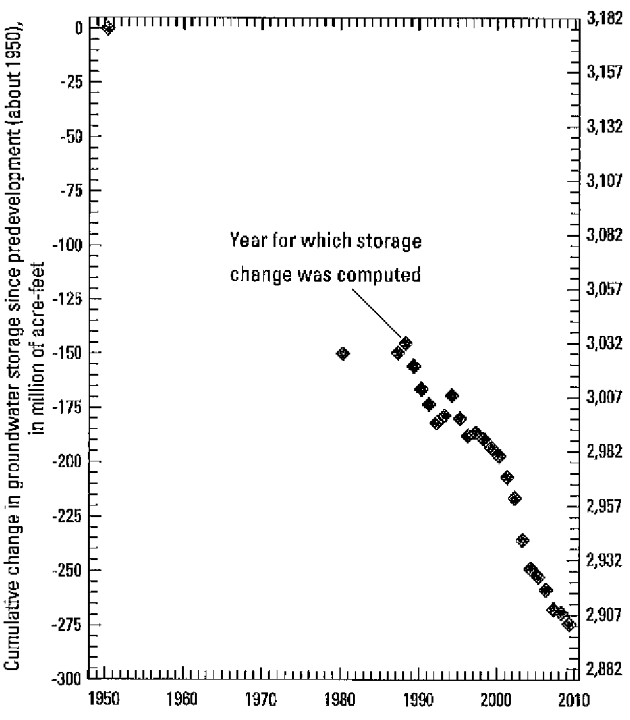


Figure 4. Cumulative change and total water in storage in the High Plains aquifer, predevelopment to 2009 (modified from McGuire, 2009).

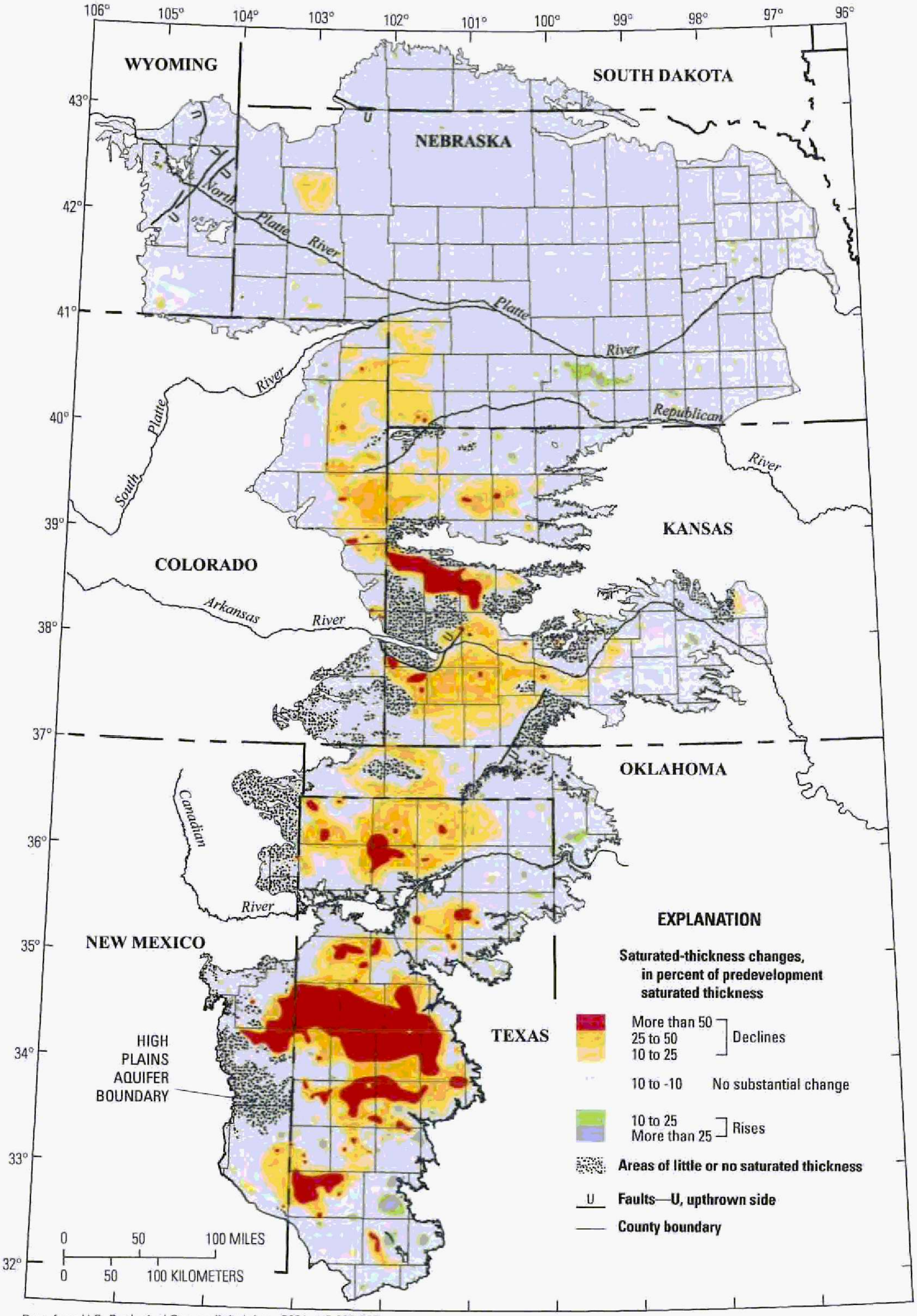
Table 3. Change in water in storage in the High Plains aquifer, predevelopment to 2009, 2007–08, and 2008–09 by State, by regional subdivision of the aquifer, and in total.

[Positive values for increases in water in storage; negative values for decreases in water in storage]

	Change in water in storage		
	Predevelopment to 2009 (million acre-feet)	2007–08 (million acre-feet)	2008–09 (million acre-feet)
	State		
Colorado	-19.4	-1.3	-0.7
Kansas	-64.7	-.6	-1.1
Nebraska	-16.6	2.5	2.3
New Mexico	-11.4	-.2	-.9
Oklahoma	-13.0	-.3	-.5
South Dakota	-.5	0	.1
Texas	-144.5	-.5	-3.9
Wyoming	-2.6	-.4	.1
Regional subdivision of the High Plains aquifer (Weeks and other, 1988)			
Northern High Plains	-47.1	1.1	2.0
Central High Plains	-123.7	-2.5	-3.8
Southern High Plains	-102.3	.6	-2.9
High Plains aquifer	-273.0	-0.8	-4.7

Summary

The High Plains aquifer underlies 111.8 million acres (175,000 square miles) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Water-level declines occurred in parts of the High Plains aquifer soon after the onset of substantial irrigation with groundwater (about 1950). In response to water-level declines, Congress directed the U.S. Geological Survey to monitor water levels in the aquifer; in 1987, the U.S. Geological Survey, in collaboration with numerous Federal, State, and local water-resources entities, began monitoring water levels in more than 7,000 wells. Water levels were measured in 9,297 wells in 2007; 9,416 wells in 2008; and 9,177 wells in 2009. This report presents water-level changes in the High Plains aquifer from predevelopment (about 1950) to 2009, from 2007 to 2008, and from 2008 to 2009. The water levels used in this report generally were measured in winter or early spring, when irrigation wells typically were not pumping, and after water levels generally had recovered from pumping during the previous irrigation season. The report also presents changes in water in storage and saturated thickness from predevelopment to 2009.



Base from U.S. Geological Survey digital data, 2001, 1:2,000,000
Albers Equal-Area projection
Standard parallels 29° 30' and 45° 30', central meridan -101°

Figure 5. Change in saturated thickness of the High Plains aquifer, predevelopment to 2009 (modified from Luckey and others, 1981; Gutentag and others, 1984).

The map of water-level changes in the High Plains aquifer from predevelopment to 2009 is based on water levels from 3,439 wells and other published data. Ninety-nine percent of the wells had water-level changes from predevelopment to 2009 that ranged from a rise of 41 ft to a decline of 178 ft. The area-weighted, average water-level change from predevelopment to 2009 was a decline of 14.0 ft.

Water levels were measured in 8,394 wells before the irrigation season in both 2007 and 2008; 99 percent of the wells had water-level changes from 2007–08 that ranged from a decline of 8 ft to a rise of 7 ft. The area-weighted, average water-level change in the High Plains aquifer during 2007–08 was a decline of 0.1 ft.

Water levels were measured in 8,474 wells before the irrigation seasons in both 2008 and 2009; 99 percent of the wells had water-level changes from 2008–09 that ranged from a decline of 9 ft to a rise of 7 ft. The area-weighted, average water-level change in the High Plains aquifer during 2008–09 was a decline of 0.3 ft.

Total water in storage in 2009 was about 2.9 billion acre-ft, which was a decline of about 273 million acre-ft (or about 9 percent) since predevelopment. By 2009, 13 percent of the aquifer area had sustained more than a 25-percent decrease from its predevelopment saturated thickness, 5 percent of the aquifer area had more than a 50-percent decrease, and less than 1 percent of the aquifer area had more than a 10-percent increase.

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http://ne.water.usgs.gov/

McGuire—**Water-Level Changes in the High Plains Aquifer, Predevelopment to 2009, 2007–08, and 2008–09**—Scientific Investigations Report 2011–5089

Exhibit 5

Barfield
DEPOSITION EXHIBIT
5

Division of Water Resources
109 SW 9th Street, 2nd Floor
Topeka, Kansas 66612-1283

Kansas

phone: (785) 296-3717
fax: (785) 296-1176
www.ksda.gov/dwr

Dale A. Rodman, Secretary
David W. Barfield, Chief Engineer

Kansas Department of Agriculture

Sam Brownback, Governor

Senate Committee on Agriculture
Testimony on SB 272, Multi-year Flex Accounts
David Barfield, Chief Engineer
January 18, 2012

Chairman Taddiken and members of the committee,

I am David Barfield, Chief Engineer of the Kansas Department of Agriculture's Division of Water Resources. I appear before you today to testify in support of SB 272, amending K.S.A. 82a-736, a provision of the Kanas Water Appropriation Act which authorizes and governs multi-year flex accounts. Attached to my testimony is my report to the Legislature on the implementation of the program for the past year, as the statute requires. That report also provides some of the history of the 2011 drought, as well as KDA-DWR's response in developing this bill.

K.S.A. 82a-736 is a complex section of the Kansas Water Appropriation Act, and the proposed amendments to K.S.A. 82a-736 increase its complexity to provide more options to water right holders. However, these amendments can be easily understood as three related changes—changes that respond to the drought of 2010-2011 and what we have learned from it.

First, the bill increases the amount of groundwater that can be pumped under a flex account, without increasing overall water use. The statute allows water right holders to exchange annual pumping maximums for a five-year maximum, enabling substantial flexibility in year-to-year pumping. However, as currently enacted, the statute imposes a water penalty for that flexibility, by requiring a ten-percent reduction in that five year quantity to promote water conservation. Largely because of this penalty, very few water users have placed their water rights into flex accounts, and so the statute has conserved little water. This first change does away with the ten percent reduction for conservation. To make this intent clear, a new subsection (a) has also been added to the statute.

Second, the bill provides three different potential options for water users to compute the amount of water that they can place into a flex account. They can use the average annual historic usage of the water right, based on the years 2000 to 2009, multiplied by five. Or, they can use the normal irrigation requirement for crops in their county, multiplied by their maximum irrigated acres, again multiplied by five. Finally, where available, they can use a GMD-developed alternative, provided that it does not increase long-term water use.

Third, the statute is drafted so that it can be implemented as quickly as possible. Due to high stakeholder interest in taking advantage of this modified flex account for 2012, KDA-DWR has included more specifics in the legislation than it otherwise would—including an expansion of the definition section, and more reliance on regulations than is otherwise desirable. While these expediencies make for a longer and more complex statute, DWR and stakeholders believe that that is a price worth paying, given the benefits the amendments provide. For example, the flex account tool will be especially beneficial to water users who significantly overused their 2011 authorized quantities under drought emergency term permits, by allowing them five years to "pay back" their overuse, rather than just one.

DWR's experience in processing the drought emergency term permits made it clear that landowners needed a clearly defined and concise water right for their flex account permit. Because water right owners may not want to place all of a water right into a flex account permit, we expect that the advantages of these accounts will produce more requests to divide water rights. To that end, Section 1 of the bill provides for such division. By dividing a water right into multiple rights, this section will allow water right holders to enroll one or more points of diversion authorized under one divided right into a multi-year flex account, while leaving the other divided right (or rights) outside the flex account. This section makes our current practice of dividing water rights explicit in statute, and provides a fee of $300 for the division, no matter how many wells are involved.

In conclusion, I believe the proposed amendments to K.S.A. 82a-736 will provide for multi-year flexibility without increasing long term water use.

Thank you. I will stand for questions at the appropriate time.

Attachments:
Attachment 1, Report on Implementing Multi-Year Flex Accounts, January 18, 2012

Exhibit 6

Distribution of Water Litigation Moneys – 2011 Senate Sub. for HB 2133

Effective July 1, 2011

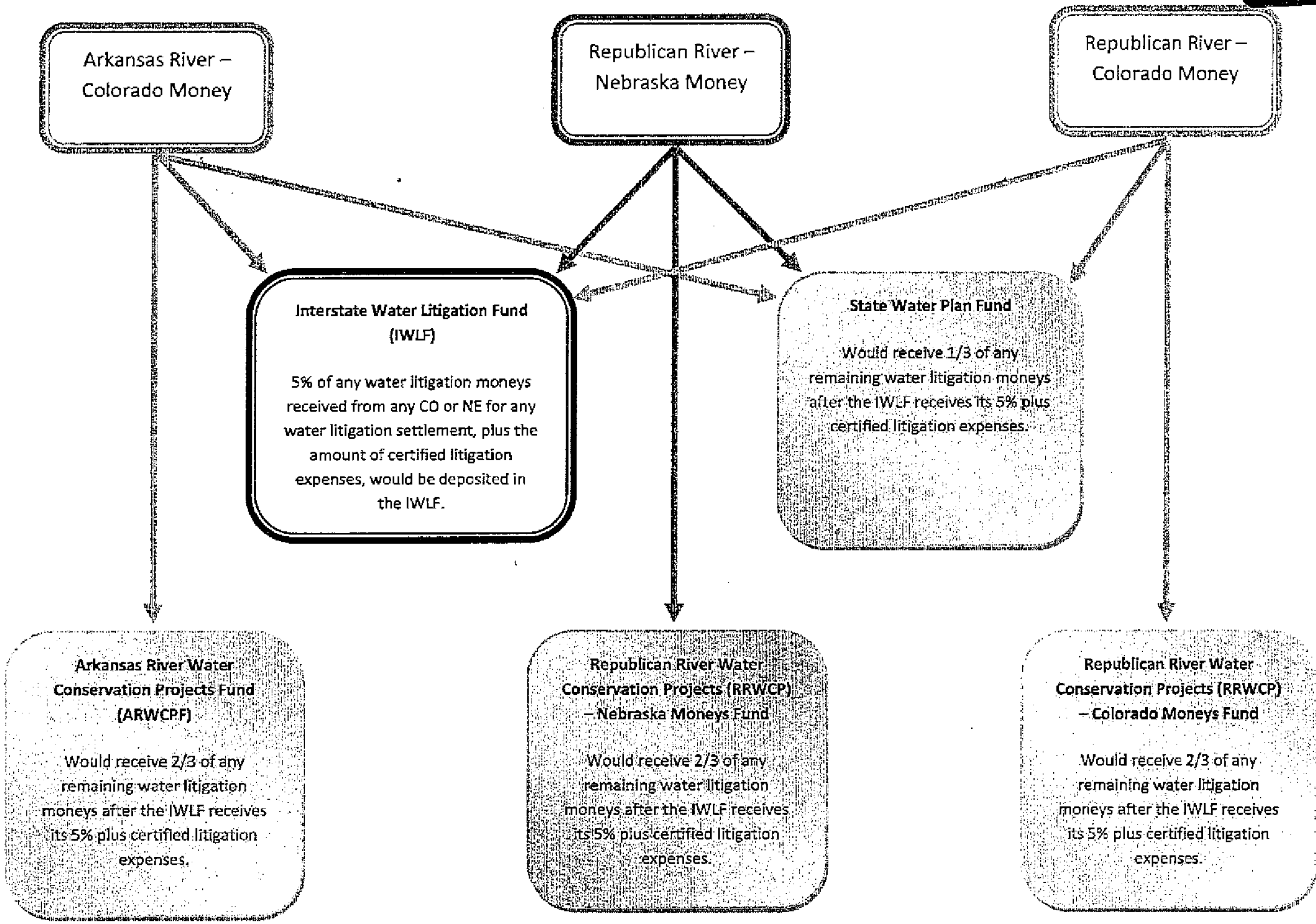


Exhibit 7

Barfield
DEPOSITION EXHIBIT 7
PENGAD 800-631-6989

System Administrator

From: Swanda, Marvin R <MSwanda@usbr.gov>
Sent: Wednesday, June 09, 2010 7:10 AM
To: Barfield, David; Ross, Scott; Juricek, Chelsea
Cc: Thompson, Aaron M; NKA CFiles
Subject: Middle Republican NRD Hearing--June 8, 2010
Attachments: AR-BC320_20100608_145331.pdf

All:

As requested please find the written statement that was presented at the MRNRD/DNR hearing on the proposed Integrated Management Plan by Reclamation.

Marvin R. Swanda, P.E.
Office Manager
McCook Field Office
1706 W. Third St.
McCook, NE 69001

Phone: 308-345-1027
Cell: 308-340-1027
mswanda@usbr.gov

**Statement of the Bureau of Reclamation
Nebraska-Kansas Area Office
Aaron M. Thompson, Area Manager**

**Regarding Proposed Integrated Management Plan for the
Middle Republican Natural Resources District**

June 8, 2010

INTRODUCTION

The Bureau of Reclamation (Reclamation) recognizes the appropriate role of the State of Nebraska to establish and enforce water policy. The current State water policy of developing and implementing Integrated Management Plans (IMP) is a step in the right direction. However, Reclamation is concerned that the IMP proposed by the State and the Middle Republican Natural Resource District (MRNRD) is inadequate. It fails to protect Reclamation's senior water rights from direct and substantial groundwater development of the hydrologically connected waters of the Republican River Basin (Basin) that occurred following approval of the Compact and subsequent investment of infrastructure.

Reclamation contends the State water policy that has evolved following approval of the Republican River Compact (Compact) ignores the physical reality of the hydrological connection between surface and groundwater sources. The policy separation between surface and ground water has lead to an overdevelopment of the finite water resource in the Republican River Basin. As a result, the investment of the United States in the development of infrastructure is in jeopardy. The irrigation, recreation, and fish and wildlife benefits are currently below their potential as envisioned and authorized by Congress. The taxpayers of the United States have an expectation that their investment will be protected, which includes water rights held by the United States.

Reclamation offers to assist both the State and NRD in developing a long term solution to the issue of Compact compliance that recognizes the hydrologic connection between surface and groundwater, and protects senior water rights. A potential option is the establishment of a water market as exists in other Reclamation states, such as the system that presently exists in the South Platte River Basin in Colorado.

COMPACT HISTORY

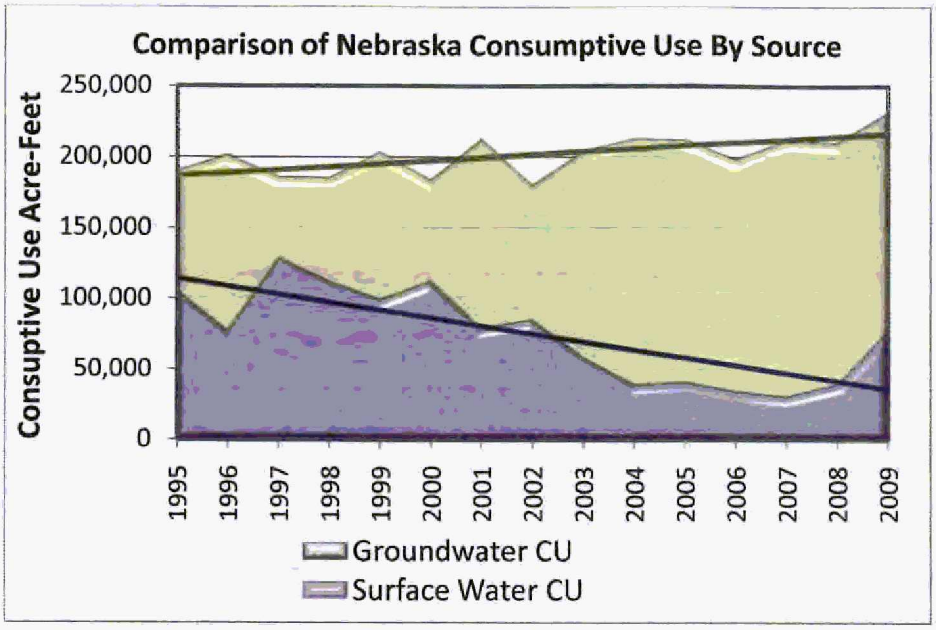
During the late 1930s when Reclamation was initially investigating the water projects in the Basin, we recognized the first step to Federal water development was negotiation of a compact between Nebraska, Kansas, and Colorado allocating water between the states. This was needed to prevent conflict between the states and to insure long term project feasibility to protect the large Federal investment. Reclamation requested that the states enter into negotiations to complete this necessary step. Reclamation stated in a 1940

Reconnaissance Report on the Basin (Project Investigation Report No. 41): "To avoid expensive litigation as a result of possible conflicting uses of water in the various states, further developments for irrigation should be preceded by a three-state compact or similar agreement on use of water." This report was one of many sources of information used by the three states to develop the Compact. Reclamation also assisted the states in the Compact negotiations by preparing hydrology analysis for the Basin and sharing Reclamation's preliminary water development plans with each of the states. The first attempt to adopt the Compact by the states was vetoed by President Roosevelt because the United States did not participate in the negotiations of the Compact. After participation by the United States, the Compact was renegotiated and revised to include Articles 10 and 11. The renegotiated Compact was signed by the states and the representative of the United States on December 31, 1942. Ratification of the Compact by the States and the U.S. Congress followed in 1943.

After the Compact was finalized, this water allocation became the framework for the final planning and design of a system of Federal reservoir and irrigation projects that would assist each of the states in developing their allocated share of the Republican River. Reclamation believed by acquiring necessary state water rights and designing its projects within each state's allocated share of the water, the water supply for these Federal projects would be protected against future water development. Between the late 1940s and 1960s eight Federal dams and reservoirs were constructed in the Basin above the Nebraska-Kansas stateline. Reclamation entered into repayment or water service contracts with each of its irrigation districts in the Basin to provide for repayment of the irrigation portion of construction and their associated operation, maintenanee, and replacement (OM&R) costs for these projects. This was done with the expectation that the irrigation districts would be able to repay their share of the project costs, protecting the invested interest of the taxpayers of the United States.

COMPACT ACCOUNTING

From 2003 through 2006, Nebraska's allocation averaged 205,000 acre-feet and Nebraska's use averaged 250,000 acre-feet, each year resulting in computed beneficial consumptive use exceeding Nebraska's allocation. During this period Nebraska ground water pumping caused nearly 80% of the ground water depletions to the streamflows in the basin. The following graph shows Nebraska's ground water and surface water consumptive use since 1995. Statistical trend lines have been added to the graph to show how these consumptive uses have changed over time. Ground water consumptive use has gradually increased over time, while there has been a sharp decline in surface water consumptive use.



Reclamation testified at each of the IMP hearings that surface water supplies in the Basin began to decline significantly in the late 1960s, right at the time ground water development in the Basin was expanding at a rapid rate. The use of surface water is not the reason Nebraska has failed to be in compliance with the Compact. Surface water use has decreased over time. Because of the current level of ground water use in the basin, ground water depletions have resulted in significant Compact compliance deficits for Nebraska. This draft IMP continues to allow for the unreasonable use of surface water supplies to make up for deficits caused by years of ground water overuse. In water-short years, surface water users experience significant water shortages because of imposed reductions in surface water supplies while ground water users have the capability to pump sufficient ground water to meet most of their irrigation demands. As a result, ground water depletions to surface flows have continued to gradually increase while surface water depletions continue to decline.

2009 ARBITRATION

Reclamation testified at the Republican River Compact Arbitration hearings in April 2009 and stated our concern that without additional limits and controls on ground water use the surface water supplies in the Basin will continue to decline making it more difficult for Nebraska to meet Compact compliance in the long term. Reclamation concurs with Arbitrator Dreher's decision that "…Nebraska's current IMPs are inadequate to ensure compliance with the Compact during prolonged dry years" and "Nebraska and the NRDs should make further reductions in consumptive ground water withdrawals beyond what's required in the current IMPs." It is our position that ground water consumptive use must be reduced to a level that will allow base flows to recover to an extent that will allow Nebraska to consistently comply with the Compact in both the near term and long term. This is the only way Nebraska can meet the IMP goal of "sustaining a balance between water uses and water supplies . . ." Likewise, Arbitrator Dreher concluded in his Final Decision that "Nebraska's problem in complying with the Compact is groundwater CBCU, not surface water CBCU." As long as ground water depletions continue to increase, there will be less and less surface water supplies available to offset the deficits caused from ground water pumping.

CONCERNS AND EXPECTATIONS

Reclamation is very concerned about Nebraska's failure to meet Compact compliance since compliance accounting was reinitiated in 2003. Reclamation is even more concerned about the continuing depletion of inflows to Federal reservoirs. Federal projects were constructed based on the eoncept that project surface water rights would be proteeted. The trend of declining ground water levels will result in continuing stream flow depletions. This draft IMP fails to address impacts from past ground water use and future ground water declines that will cause direct and substantial depletions in stream flows.

Reduced surface water supplies have caused Federal project water deliveries, throughout the Basin, to decline during the last 40 years. Ground water pumping in the MRNRD directly affects the water supply for several canals associated with the Federal projects in the Basin. A decline of return flows from these canals has reduced supplies to downstream Federal projects as well. According to NE Stat. 46-715, the IMP should include clear goals and objectives with the purpose of sustaining the balance between water uses and water supplies for both the near term and the long term. Reclamation is very concerned with this balance in the Basin as it relates to surface water supplies for existing surface water uses.

Reclamation expects the water rights associated with the authorized Federal multipurpose projects in the Basin be protected by the State of Nebraska and the NRDs. Reclamation expects to continue to operate the Federal projects for their authorized purposes. Reducing ground water depletions is the only way to gradually allow the streamflows to recover, provide equity among water users, and assist Nebraska in achieving long term Compact compliance.

SPECIFIC COMMENTS

1. Goal 4 – "reserve any streamflow available from regulation, incentive programs, and purchased or leased surface water required to maintain compact compliance from any use that would negate the benefit of such regulations or programs" Since any water that appears as streamflow is subject to storage and surface water use in accordanee with Nebraska state statues, how does the state intend to meet this goal?

2. Goal 5 – "protect ground water and surface water users…from stream flow depletions caused by ground water or surface water uses began after the date the river basin was designated as fully appropriated." This goal is not being met and will not be met by the proposed IMP. Records indicate depletions from ground water have increased since 2004 and ground water levels are continuing to decline.
3. The IMP requires a 20% reduction in pumping to average a level no greater than 247,580 acre-feet but then allows higher pumping in any single year Allowing higher pumping levels in "water short" years works against compliance and equity between surface water users and ground water users.
4. The MRNRD's current pumping volumes are near a 20% reduction from the '98-'02 baseline volumes discussed in the IMP. The '98-'02 baseline is not representative of average pumping as this was a dry period when pumping rates were high. Reductions need to be higher to improve surface water supplies and achieve long-term compliance. Reducing allocations by more than 20% will provide a cushion to offset deficits in dry or water short years. This would reduce the need for other users to unfairly make up the deficit.
5. The proposed IMP does not address improving long-term surface water flows nor make up existing deficits. Improved surface water flows will be needed to achieve long-term compliance.
6. The Surface Water Controls as described in section VIII.F are vague and do not describe the intent of "Compact Call."
7. The "Compact Call Year" is not defined in the draft IMP. Also a number of the terms under the Compact Call Year evaluation are not clear.
8. The IMP indicates that a "Compact Call" will be placed on the river at Guide Rock or Hardy on all natural flow and storage permits. This call would appear to prevent storing water in Harlan County Lake decreasing the water supply for the Bostwick Division. This call would also appear to prevent the diversion of natural flow into the Courtland Canal. Is this the intent of the Compact Call? This could also increase the number of years that are designated as "water-short years" under the terms of the Final Settlement Stipulation.
9. Closing all natural flow rights and storage rights while not curtailing all ground water wells hydrologically connected to the streams (as defined by the FSS) is discriminatory and does not provide equity between water users (a primary goal of the IMP).
10. The IMP states that a "Compact Call" is on until such time that administration is no longer needed. The IMP is unclear whether any ground water use in the Rapid Response Area will occur during a "Compact Call Year". Will ground water use remain off during the entire year when a "Compact Call" has been placed?
11. The IMP does not define "allowable surface flow depletions." A better understanding of the surface water user's share of allowable depletions is needed. Surface water supplies are already reduced during "water short" years. Ground water consumptive use has remained the same or increased and under the IMP a higher volume of ground water pumping is allowed in years with below average

precipitation. This is completely contrary to providing equity between surface water uses and ground water users.

CONCLUSION

Reclamation is supportive with Nebraska's effort to comply with the Compact. However, a plan that essentially curtails all surface water use and continues to allow ground water use and ground water mining to occur in the Basin is unreasonable and not acceptable. This is not consistent with Nebraska Statute 46-715 as surface water users are not being provided equal protection among all water users. Reclamation views our Federal water rights as property rights that must be provided equal protection. The fiscal investment of the taxpayers of the United States must also be protected. In doing so, the IMPs should not ignore the physical reality that ground water and surface water are hydrologically connected and the administration of the water supply in the basin should be consistent and equitable for all water users.

Additionally, the proposed revisions to the IMP do not allow Reclamation to operate as authorized by the U.S Congress. If adopted, this IMP would prevent Reclamation from performing its contractual obligations of delivering water to irrigation districts in "Compact Call" years. Federal projects were specifically designed to be in compliance with the Compact and our use has not increased over time but decreased as a result of uncontrolled depletions upstream of our reservoirs. Inadequate water supplies, because of depleted stream flows in the MRNRD, adversely affect surface irrigators who were planning on supplies expected after the signing of the Compact. Depleted surface water deliveries directly and substantially reduce the economic benefits provided by the Federal projects.

Reclamation needs a better understanding on how the surface water controls of this proposed IMP will work. If the state recognizes the administration of water in the basin for Compact compliance as a "beneficial use" then the senior water right holders in the basin should be compensated. Bypassing inflows from upstream reservoirs to store water in Harlan County Lake is, in our view, a "selective call". Two of Reclamation's reservoirs upstream are senior to Harlan County Lake and the other reservoirs have an equal water right priority to that of Harlan County Lake. Additionally, if <u>all</u> natural flow permits are closed, as indicated in the proposed IMP, what authority will be used to supply water to the Courtland Canal and Lovewell Reservoir during "Compact Call" years? If the water cannot be stored or diverted as indicated in this IMP, then the water flowing through our reservoirs is no longer project water. Reclamation does not currently have authority to transfer non-project water through Courtland Canal for a non-project use. Finally, Reclamation is concerned that "Compact Call" years could result in surface water users losing irrigation supplies for multiple years as the reservoirs ability to store water is reduced. The financial viability of our irrigation districts, which supplies water to approximately 700 users in Nebraska, would be in jeopardy if this would occur. This is unreasonable. Other impacts coupled with reduced reservoir levels will occur to recreational and fish and wildlife benefits associated with these projects. It is our understanding that DNR predicts surface water users will be curtailed 2 out of 10 years.

Please provide us with the modeling and supporting data showing the frequency that surface water curtailments will occur.

As an alternative, Reclamation believes the water supplies of the basin should be managed fairly across the basin for all water users. A long term conjunctive management approach should be developed that allocates consumptive use in an equitable manner across the basin. This approach would allow water to be marketed between all users based on consumptive use. Surface water should be provided with an equitable share of Nebraska's consumptive use during "water short" years. We again want to stress that the earliest water rights in the basin are the surface water rights that are currently not being provided "equity among water users" and if this IMP is adopted, will not be in the future. Sustained surface water supplies are critical for project viability and Nebraska's ability to be in compliance in the long term.

In conclusion, Reclamation is willing to continue working with all the NRDs and the State as they seek compliance with the Compact. The IMP should recognize and protect the investment of the United States' taxpayers made decades ago. To ensure compliance in the long term, Reclamation believes there must be a healthy surface water component in the Basin. To accomplish this we believe reduction in ground water pumping must be significantly more than currently provided in the IMP.to allow stream flows to begin to recover. Ground water pumping and other upstream uses are progressively depleting reservoir inflow.

Reclamation is hopeful as you finalize the IMP that you will study the presented testimony and respond to our specific questions and concerns we have presented in this statement.

Aaron M. Thompson

Aaron M. Thompson, Area Manager

Exhibit 8

Barfield
DEPOSITION
EXHIBIT
8

PENGAD 800-631-6989

System Administrator

From: Erger, Patrick J <PErger@usbr.gov>
Sent: Wednesday, August 18, 2010 8:55 AM
To: Ross, Scott
Subject: RE: Meeting of Great Minds

Scott,

I thought the discussion yesterday was good. I hope that Kansas was able to get some useful information from the discussion.
Thanks,
Patrick

From: Ross, Scott [mailto:Scott.Ross@KDA.KS.GOV]
Sent: Friday, August 13, 2010 9:55 AM
To: Erger, Patrick J
Subject: Meeting of Great Minds

Patrick,

This is the meeting between DWR and USBR in Topeka on the 17th. If we need a web conference we'll set it up and let you know how to log in.

Scott

Tuesday August 17th
Time 9:00 am to 12:00 central

Call information
Phone # 866.620.7326
Conference code: 259.606.1270

System Administrator

From: Ross, Scott <Scott.Ross@KDA.KS.GOV>
Sent: Wednesday, August 18, 2010 8:59 AM
To: Erger, Patrick J
Subject: RE: Meeting of Great Minds

Sir Patrick,

I thought it went well, and we definitely got some input we needed to understand the USBR point on operational changes. The real question is where does this take us from here. The other matter that I was glad to see, is a closer DWR/USBR relationship. Hopefully, this is the start of good things to come.

Keep a tight line.

Scott

From: Erger, Patrick J [mailto:PErger@usbr.gov]
Sent: Wednesday, August 18, 2010 9:55 AM
To: Ross, Scott
Subject: RE: Meeting of Great Minds

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Call information
Phone # 866.620.7326
Conference code: 259.606.1270

Exhibit 9

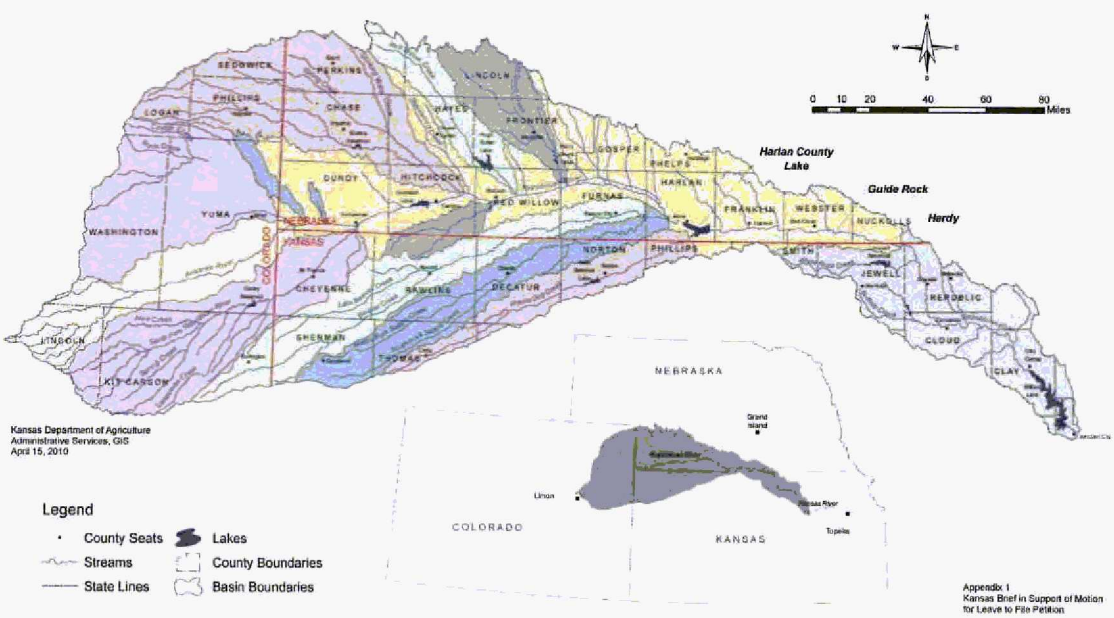
Republican River Compact Enforcement

David Barfield, Kansas Chief Engineer
John Draper, Kansas Counsel

Presentation to the Bureau of Reclamation

September 30, 2010

Republican River Basin



Republican River Compact (1943)

- Compact was formed as a prerequisite for federal flood control and irrigation projects
- Three States: Kansas, Colorado and Nebraska
- Approved by the States, Congress and the President
- Allocates 100 percent of the basin's water supply among the states.
- If one state uses too much, the downstream state is shorted

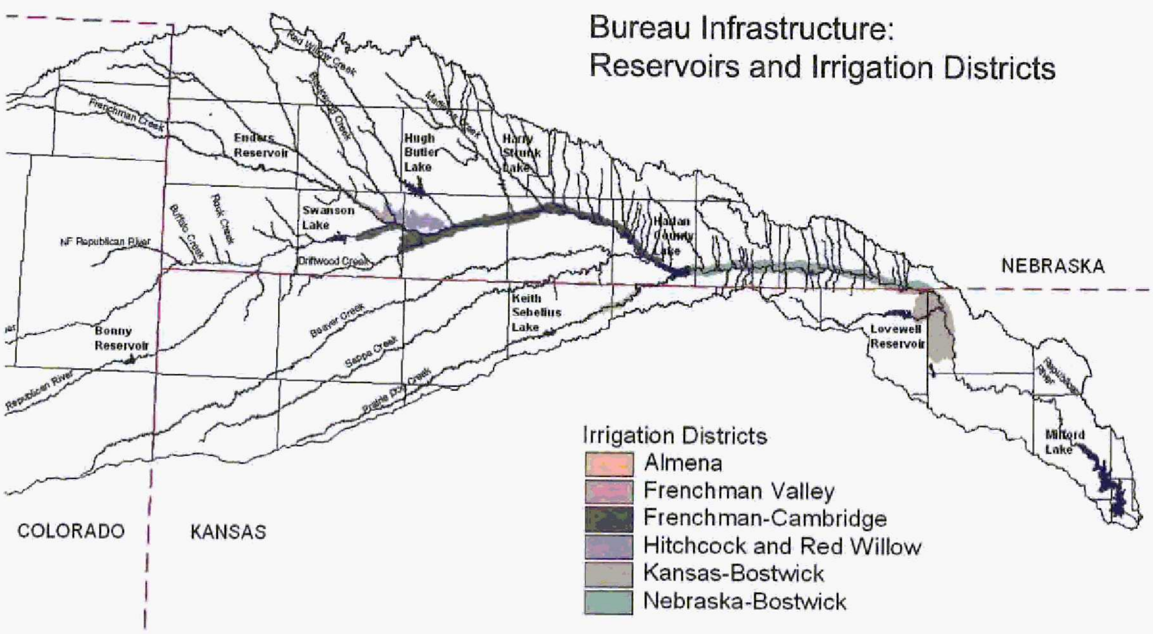
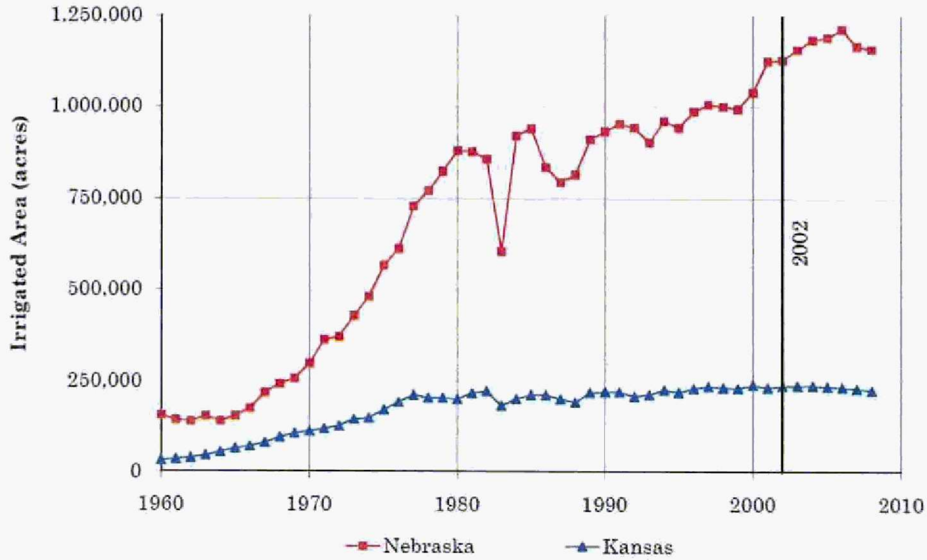
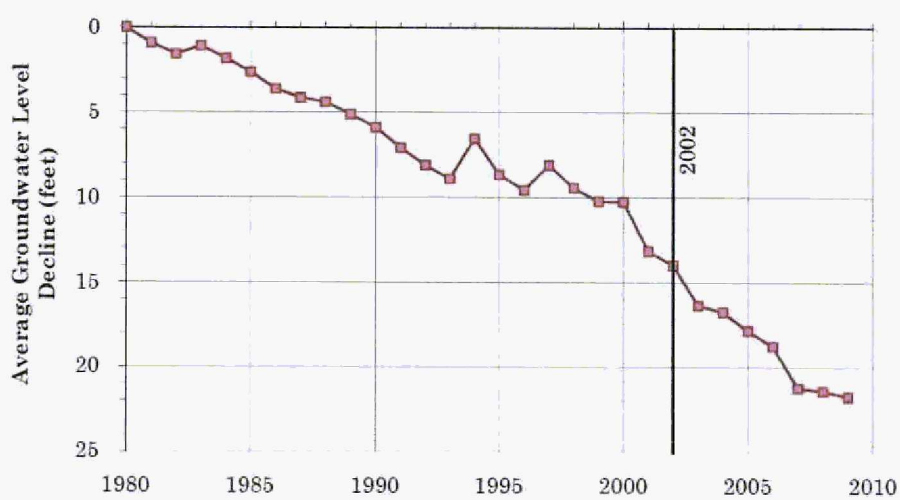


Figure 5
Groundwater Irrigated Area
Republican River Basin, Nebraska and Kansas



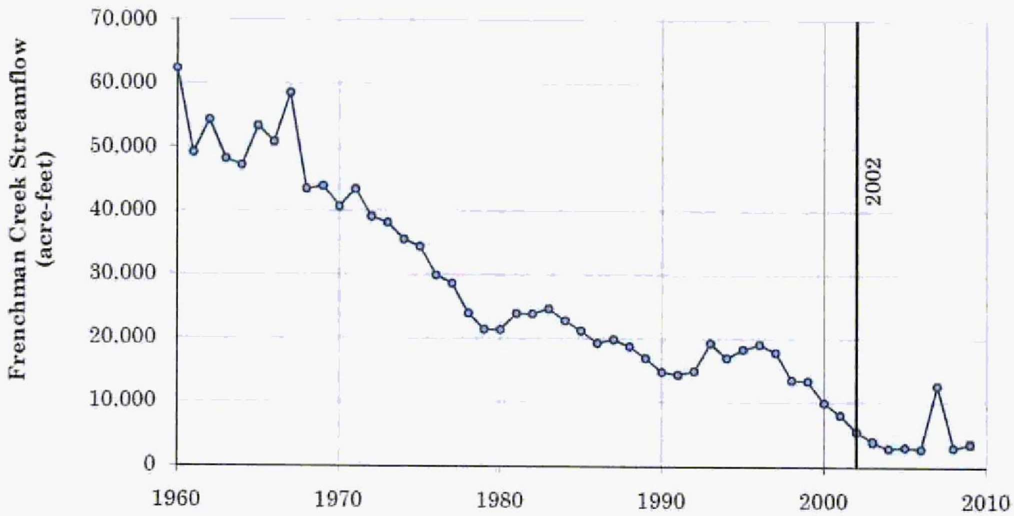
Source: Republican River Compact Administration Groundwater Model data.

Figure 2
Average Groundwater Level Decline
Upper Republican Natural Resources District, Nebraska



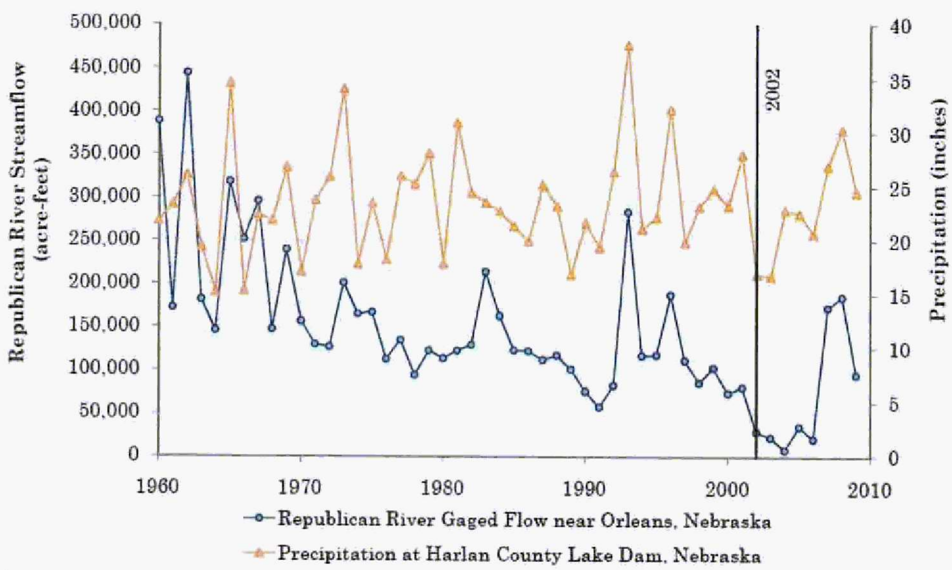
Source: United States Geological Survey National Water Information System
Note: Each data point represents the average for wells with data in 1980 and each corresponding year. Number of observations included in each average value varies from 190 to 238.

Figure 3
Frenchman Creek Annual Streamflow
Upper Republican Natural Resources District, Nebraska



Source: United States Geological Survey (1960 - September, 1994) and Nebraska Department of Natural Resources (October, 1994 - 2009). Gage 06831500 Frenchman Creek near Imperial, Nebraska

Figure 4
Annual Republican River Streamflow (1) and Local Precipitation (2)
Harlan County Lake, Nebraska



Source:
(1) United States Geological Survey Gage 06844500 Republican River near Orleans, Nebraska
(2) United States Bureau of Reclamation precipitation at Harlan County Lake Dam

Compact Enforcement History

Year	Issue
1980s - 1990s	Nebraska begins to overuse its share. Kansas seeks to address concerns via the Compact Administration
1998	Kansas files suit in U.S. Supreme Court. Nebraska asserts that the Compact does not include groundwater.
2000-2002	Court rules that groundwater pumping must be accounted for; States negotiate comprehensive settlement
2003	U.S. Supreme Court approves settlement
Settlement includes clear compact compliance requirements and jointly developed groundwater model/accounting methods	

The Final Settlement Stipulation (FSS)

- Kansas waives damages for pre-2003 violations of the Compact
- Provides methods for quantifying and allocating the water supplies of the Basin, using the RRCA groundwater model
- RRCA Groundwater model cooperatively developed
- Provides calendars of compliance:
  - Normal years: five-year test
  - Water-short years: two-year average test

Nebraska's water management

- Nebraska regulates surface water at the state level, but leaves groundwater to local natural resource districts, or NRD's.
- Under Nebraska law, it is difficult to curtail groundwater pumping to protect senior surface rights (such as the Bureau's).
- Groundwater interests appear to be more powerful than surface water interests in Nebraska, so political reform seems unlikely.

Nebraska's Integrated Management Plans ("IMPs")

- Nebraska is now developing its third round of IMPs.
- Nebraska's latest IMPs continue to protect groundwater pumping.
- Surface water users face curtailment by the State, while groundwater users enjoy a range of options to avoid curtailment.
- IMPs provide that the state may call water through the federal reservoirs to the detriment of the Bureau's projects and Kansas.

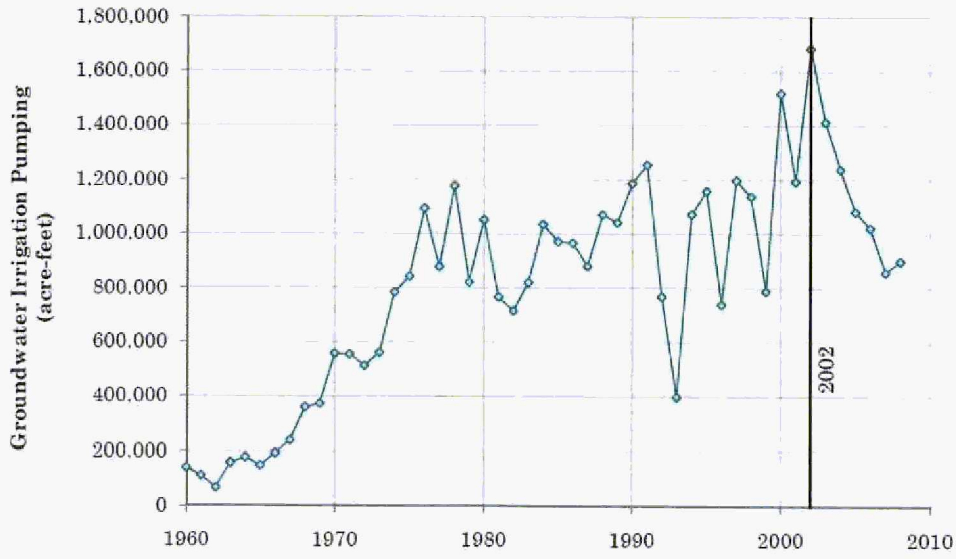
Nebraska violated its first three compliance tests under the FSS:

Year	Nebraska's Overuse
2005	42,860 acre-feet
2006	36,100 acre-feet
Total	78,960 acre-feet

Nebraska Water Short Year Test for 2006

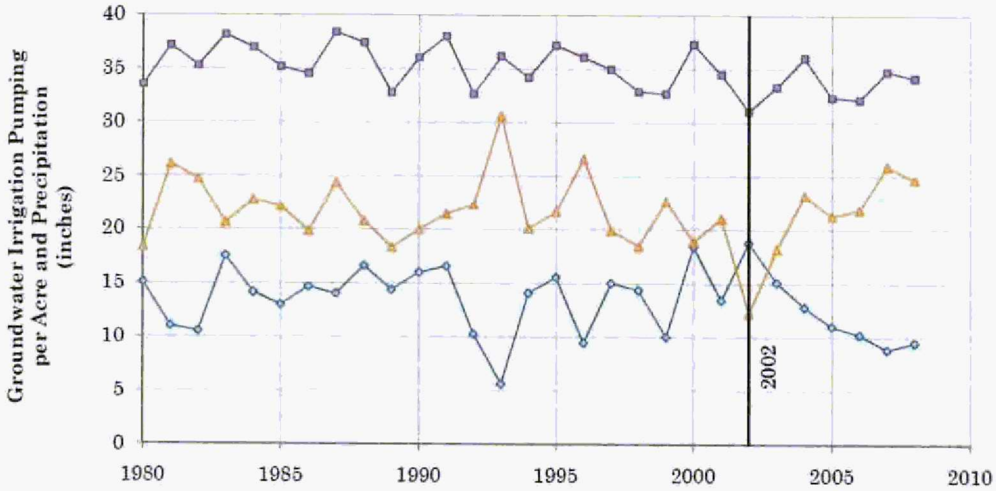
- Nebraska also failed its second water-short year test (2006-2007).
- Nebraska has failed its first five-year test as well (2003-2007) .
- Nebraska had four years to respond to the FSS, but took very limited action despite clear indications of overuse.

Figure 6
Groundwater Irrigation Pumping by Nebraska
Republican River Basin, Nebraska



Source: Republican River Compact Administration Groundwater Model data.

Figure 8
Nebraska Groundwater Irrigation and Precipitation
Republican River Basin, Nebraska



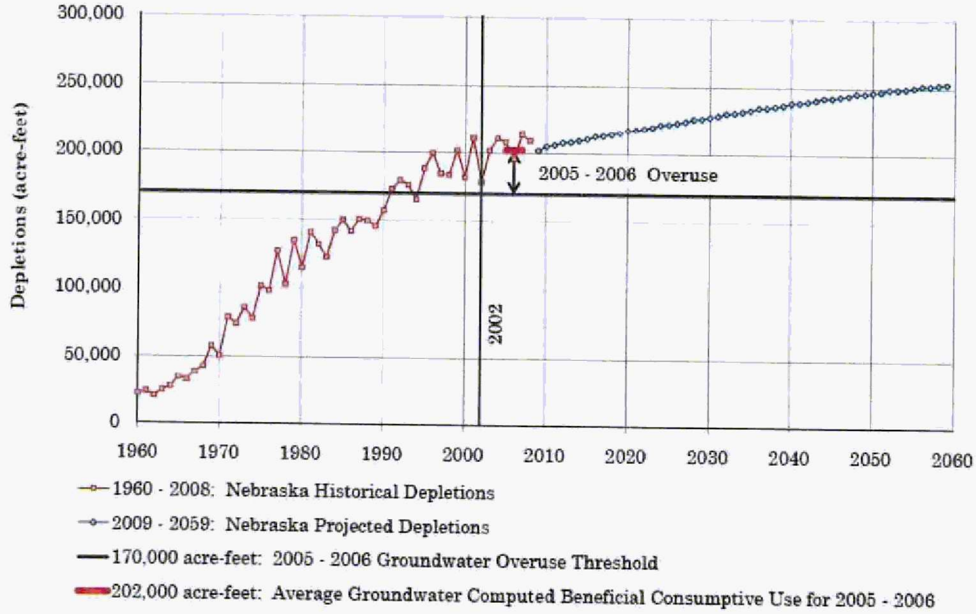
Nebraska Groundwater Irrigation Pumping per Acre on Groundwater Only Pumping Lands
Precipitation, Republican River Basin, Nebraska
Sum of Groundwater Irrigation Pumping per Acre Plus Precipitation

Source: Republican River Compact Administration Groundwater Model data.

Current "compliance" is due principally to wet conditions

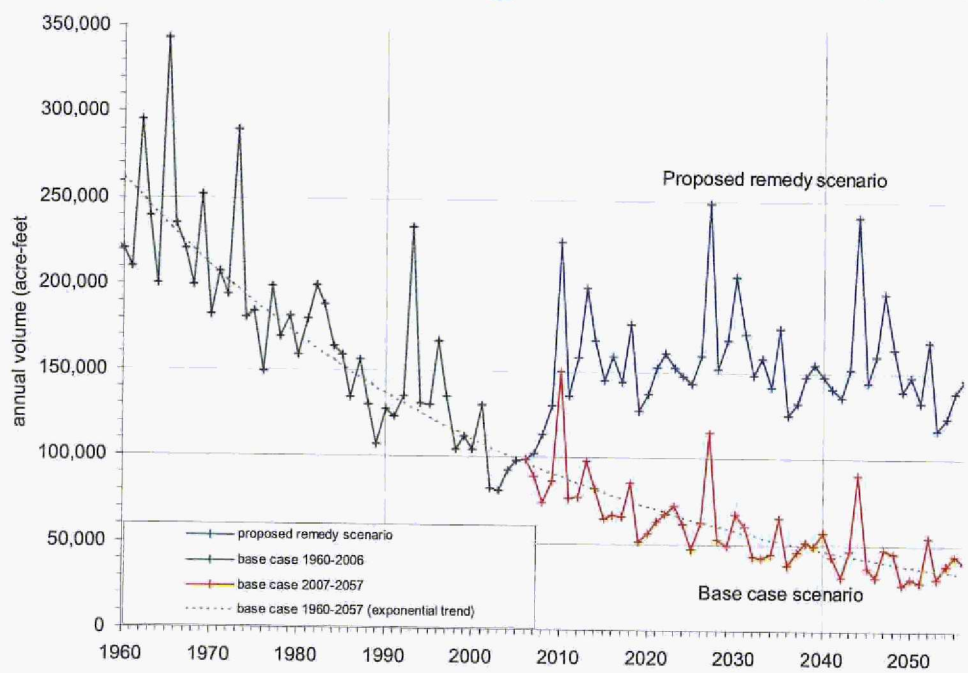
- Water supply and allocation have increased since 2006, disguising Nebraska's increased water use.
- Reductions in pumping since the peak of 2002 correspond with increased precipitation, which has reduced irrigation requirements.
- Depletions to Basin water supply continue to grow.
- Consumptive use in Nebraska remains effectively unchecked.

Figure 7
Depletions of Republican River Streamflow Above Guide Rock, Nebraska
By Nebraska Groundwater Pumping
Historical and Projected



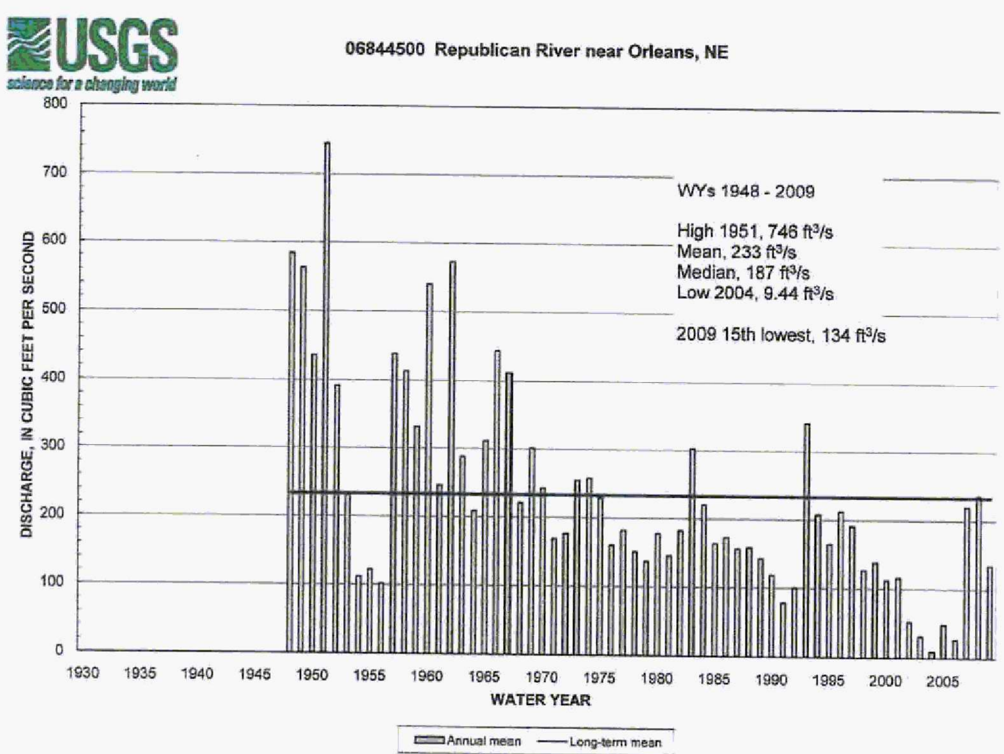
Source:
(1) Historical Depletions - Republican River Compact Administration Groundwater Model results.
(2) Projected Depletions - Republican River Compact Administration Groundwater Model results generally based on average conditions for years 1959 - 2008 and 2003 - 2008 average groundwater pumping per acre.

Baseflows – historic and future; with and without meaningful Nebraska action



The Consequences of noncompliance: Impacts to Basin surface water projects

- Consistent concerns of the Bureau, made most recently at the 2010 RRCA Meeting in Burlington, Colorado
- U.S. Geological Survey report at the 2010 RRCA meeting: despite higher precipitation throughout the Basin, streamflows remain below average
- Surface irrigation districts *in Nebraska* are concerned by Nebraska's plans to comply with Compact by depriving them of water in storage: Frenchman Cambridge Irrigation District, for example



Kansas actions to enforce the Decree

- December 2007 - Kansas begins dispute resolution process before the Republican River Compact Administration (RRCA)
- July 2009 - Non-binding arbitration concluded
- Filing before the US Supreme Court, May 2010

What Kansas is seeking

- Contempt
- Injunction from further violations
- Damages
- Preset sanctions for further violations
- Significant reductions in groundwater pumping or the equivalent
- River Master

Kansas and federal concerns are largely congruent

- Kansas is concerned with the viability of Bureau projects because they are the main means by which we obtain our Compact allocation.
- Kansas is opposed to Nebraska's efforts to bypass federal projects.

Summary

- Nebraska's post-decree actions have been ineffective.
- Nebraska's current actions will not achieve compliance; rather, they will increase lagged depletions, harming Bureau projects and those who depend on them, in both Nebraska and Kansas.
- Litigation in the U.S. Supreme Court is the only option left for Kansas.

Questions?

Exhibit 10

Barfield
DEPOSITION EXHIBIT
10
PENGAD 800-631-6989

WTR-2.09

KANSAS
WATER OFFICE

Kathleen Sebelius, Governor
Tracy Streeter, Director
www.kwo.org

NAME	INITIAL	ACTION	DATE
Jason			
Steve			
Mike K			
Jack			

REMARKS:

AUG 2007
RECEIVED
Official File Copy
DOR - NKAO
Grand Island, NE

August 24, 2007

Alice Johns
U.S. Bureau of Reclamation
PO Box 1607
Grand Island, NE 68802-1607

Dear Ms. Johns:

Enclosed are the proposed lake level management plans for water year 2008 for Kansas lakes. The Kansas Water Office corresponded via electronic mail, phone, and in person on February 27, 2007 with the Kansas City and Tulsa Districts of the Corps, Bureau of Reclamation, Kansas Department of Wildlife and Parks, and Kansas Department of Agriculture Division of Water Resources to establish guidelines for the upcoming water year.

The proposed plans were developed by the respective lake managers after meeting with interested parties and considering previous years' plans and guidelines provided by the above group.

I ask that these proposed plans be viewed as guidance and not hard deadlines. The beginning and end dates of drawdowns and rises should remain flexible in order to accommodate conditions at each reservoir and maximize the lake manager's ability to meet the goals of the proposed plan.

As discussed during our kick-off meeting on February 27th and in the LLMP guidance document, statute limits the amount of water that can be provided as surplus water in any one calendar year to 10% of the yield capacity, unless the Governor has declared an emergency that affects the public, health, safety or welfare. The submitted proposals for both John Redmond and Elk City reservoirs requested a drawdown that exceeds the quantity for surplus water. We proposed to reduce the drawdown for these reservoirs to ensure we remain in compliance with statute.

If you have any questions about these proposed plans, please contact me or Earl Lewis. I can be reached via phone at (785) 296-1007 or via e-mail at smetzger@kwo.state.ks.us. Earl can be reached via phone at (785) 296-3185 or via e-mail at elewis@kwo.state.ks.us.

Sincerely,

S. Metzger

Susan Metzger
Environmental Scientist

Attachments Available

SM:ms

070855

901 S. Kansas Avenue, Topeka, KS 66612-1249 • Phone: (785) 296-3185 • Fax: (785) 296-0878

Exhibit 11

No. 126, Original

In the
SUPREME COURT OF THE UNITED STATES

STATE OF KANSAS,
Plaintiff
v.

STATE OF NEBRASKA and
STATE OF COLORADO,
Defendants.

Before Special Master William J. Kayatta, Jr.

Future Impacts of Pumping on Ground Water Consumptive Use

Expert Report of Samuel P. Perkins[1] and Steven P. Larson[2]

[1]Civil Engineer, Interstate Water Issues, Kansas Dept. Of Agriculture, Div. of Water Resources;
[2]S. S. Papadopulos & Associates, Inc., Bethesda, MD.

November 18, 2011

of the four particularly dry years occurred in the sequence of annual values. The calculated GWCBCU values for each of these particularly dry years were collected for each future year in the analysis and were statistically characterized. The median of the collected values for each year shows an increasing trend of about 700 acre-feet/year per year (see Figure 6). Over the 40-year study period, this trend increased to a GWCBCU of about 218,000 acre-feet after 40 years. Our analysis included one of those particularly dry years, 2002. Each time that dry year occurred in the repeated cycle of hydrologic conditions in our analysis, GWCBCU declined to a local minimum along the generally increasing trend of annual values of GWCBCU. During the third cycle, at the 38th year of the future calculations (with 2002 hydrologic conditions), the GWCBCU was calculated in our analysis at a little less than 222,000 acre-feet. This value is only a few percent greater than the value shown by the trend after 40 years of median values for particularly dry years in the Nebraska analysis.

The comparisons described above demonstrate that the repeated 15-year cycle of hydrologic conditions for the historical years 1995 through 2009 provide a reasonable surrogate for future hydrologic conditions for the purpose of evaluating Nebraska's future GWCBCU and IWS credit using the RRCA Groundwater Model.

Additional Calculations

At the request of David Barfield, we have conducted several calculations of future Nebraska GWCBCU using the RRCA Groundwater Model under various assumptions regarding the nature and duration of future pumping curtailment in Nebraska. Specifically, three different pumping curtailment scenarios were evaluated. The first scenario calculated the impact of reducing the overall pumping in the three NRDs (UR, MR and LR NRDs) to an average of 75% of the historical average pumping during the years 1998 through 2002. In the second scenario, future pumping was removed (100% curtailment) from the Rapid Response Region (the area referred to as the 10-percent/2-year response area) defined in the NRD IMPs for each future year. In the third scenario, future pumping was removed (100% curtailment) from the Rapid Response Region for each future year corresponding to historical years 2002 through 2007 (a 6-year curtailment period during each 15-year future cycle).

Table 7 and Figure 7 tabulate and illustrate, respectively, the calculated future Nebraska GWCBCU results for the first scenario. For convenience, the results for the baseline conditions using an average of 80% of the historical average pumping during the years 1998 through 2002 have been included on the table and figure. The difference in calculated GWCBCU between the baseline using 80% of average pumping for the period 1998 through 2002 and the 75% scenario are tabulated in Table 7 and shown graphically on Figure 7a.